January 1958

Agriculture

Volume LXIV Number 10

Published for the Ministry of Agriculture, Fisheries and Food
by Her Majesty's Stationery Office

NINEPENCE MONTHLY

Jack BARCLAY
LIMITED
The Largest Official Retailers for
ROLLS-ROYCE and BENTLEY
★
BERKELEY SQUARE, LONDON, W.1
Mayfair 7444

MANUFACTURERS & DISTRIBUTORS
of **QUALITY INGREDIENTS** for
ANIMAL & POULTRY FOODS
"MAXUM" MINERALS for Pigs, Poultry & Cattle
MEAT MEAL · MEAT AND BONE MEAL
DRIED GRASS, LUCERNE (Meal & Cubes)
FISH MEAL · WHITE FISH MEAL
DRIED YEAST · BLOOD MEAL · LIVER MEAL
GREY GRANITE, FLINT & MIXED GRITS
DANISH OYSTER SHELL · VITAMINS
It will pay you to ask your usual Merchant for supplies
COUPER, FRIEND & Co. Ltd
Head Office: 33/35 EASTCHEAP, LONDON, EC3
Works: LONDON & HULL

MANGANESE
for plants

An ever increasing accumulation of literature contains numerous references to manganese deficiency affecting a large variety of crops. Many soils do not supply sufficient utilisable manganese for growing plants. Growth is retarded, root development is checked, yields suffer, and crops may fail completely.

YOU CANNOT AFFORD TO NEGLECT THIS ESSENTIAL PLANT NUTRIENT

Information about the occurrence and control of manganese deficiency in farm, garden, and orchard crops may be obtained from our Agricultural Department. We welcome your enquiries.

CHEMICAL & CARBON PRODUCTS LTD.
14J NEW BURLINGTON STREET LONDON W.1
Telephone REGent 1921 Five lines Cables CHEMICARBO LONDON

Agriculture

Volume LXIV Number 10 January 1958

EDITORIAL OFFICES
THE MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
WHITEHALL PLACE • LONDON S.W.1 • TRAFALGAR 7711

CONTENTS

Cover photograph: In line for kale *Photo: I.C.I. Ltd.*

Spraying and Dusting against Potato Blight

G. H. Brenchley, M.A.

National Agricultural Advisory Service, Eastern Region

With several methods available for obtaining blight control, the farmer may find that choosing the technique best suited to his purpose presents him with yet another problem. Mr. Brenchley discusses the comparative values of the methods, including the latest developments in spraying from the air, and "drift dusting".

Blight made its first and most devastating onslaught on the potato crops of the British Isles more than a century ago. It is still one of the potato grower's major problems. Every farmer who grows the crop on an appreciable scale has to answer for himself a number of questions—is it worth while to spray at all, and if so, shall he spray every year as an insurance, or wait to see whether it is going to be a "blight year"? What shall he spray with—one of the standard copper fungicides or the new and promising, but still comparatively untried, zineb? When shall he start spraying; for how long shall he continue spraying and at what intervals? Finally, shall he use a spray, at high or low volume, or a dust? Some of these questions are inextricably linked, but this article is primarily concerned with the last of them—that is, with methods of applying the fungicide.

Before World War II, the matter was fairly simple for, apart from one not very widely used air-blast machine, the only alternatives were a high-volume spray at roughly 100 gallons per acre or a dust. After the war, selective weed-killers brought with them the low volume sprayer (15–50 gallons per acre) and a new technique for potato blight spraying. At first, it seemed unlikely that 20 gallons per acre could give a sufficient cover on a fully-grown potato crop, but results were, in general, promising and some of the older ideas as to what was necessary for good blight control had to be called in question. For instance, the need for cover on the underside of the leaves had never been questioned, but it is now clear that adequate control can usually be achieved without it. It seems that although the blight fungus can enter the leaves more readily from the underside, so many more spores alight on the upper surfaces than on the lower that it is the tops of the leaves which need most protection.

Low volume techniques

In recent years there has been a tendency, both in agricultural and orchard spraying, to reduce the volume of water used to carry the fungicide from the sprayer to the crop. The use of the low volume machine is evidence of the trend and has now led to concentrate spraying, in which the quantities of liquid employed are as low as 1–3 gallons per acre. Obtaining a cover with these very low volumes introduces new problems in the technique of application; it is obviously impossible to wet the whole leaf area, so the aim is

now to achieve a uniform pattern of discrete droplets instead of a continuous film of liquid.

There are two ways of doing this; the first is to use very small droplets produced by a rotary atomizer and dispersed, not in water, but in an air blast. When spraying a ground crop such as potatoes by this technique, the fungicide, formulated in oil, can either be applied from a tractor-mounted machine or from an aircraft with rotary atomizers mounted on its wings. When a ground machine is used, the spray is directed upwards so that the wind can drift it down on to the crop. (If the wind is blowing at more than 10 m.p.h., wait until another day.) It is claimed that very wide swaths can be covered in this way.

The second method is to spray a concentrated suspension of the fungicide in water from a spray-boom which is similar to that used in spraying higher volumes; even distribution is obtained mainly by the rapid movement of the sprayer over the crop. This, of course, involves the use of aircraft, which may be either of the fixed wing or rotary wing (helicopter) types, though in fact most of the potato spraying done in England so far has been by helicopter.

In the last few years, the drifting technique has also been used to apply dust. The material is very fine and light, it is dispersed in a powerful air-stream generated by a tractor-mounted machine and allowed to drift into the crop very much in the manner described for drift spraying. These drifting techniques have been used successfully in the tropics, but they are hardly out of the experimental stage as far as blight control in this country is concerned.

We have then, in addition to the new drifting techniques, four methods commercially available for applying fungicide for blight control, high volume ground spraying, low volume ground spraying, concentrate spraying by aircraft, and ground dusting. Aircraft spraying is at present a contractor's job (and indeed is likely to remain so), but the other methods are equally suitable for contract work and for use by the farmer with his own equipment. A growing practice in some areas, and one which has much to recommend it, is for the farmer to hire a sprayer or duster for the season, usually buying the spray materials from the supplying firm at the same time.

It will be convenient to discuss some of the advantages and disadvantages of the various techniques one by one.

High volume ground spraying

High volume ground spraying is the oldest system, but is still as reliable as any. It is a curious commentary on the limited progress made in blight control methods that the high volume machine is the only type that can apply the effective Bordeaux mixture, which was first used in 1885, and remains unbeaten for fungicidal power and tenacity! Two disadvantages of Bordeaux mixture are the trouble of making up the fresh material on the farm, and the tendency for spray nozzles and pumps to become worn; these factors have led to this excellent fungicide being unduly neglected in recent years.

The high volume machine, applying 80–120 gallons per acre at a pressure of perhaps 250 lb p.s.i. naturally gives good cover, though there may be

considerable wastage in the form of run-off. Excellent under-leaf cover can be achieved during the earlier sprayings, before the crop has met across the rows, by the use of drop-legs. Most high volume machines spray about twelve rows at a time, although larger machines, covering about eighteen rows, are sometimes used by contractors. A big sprayer of this type will inevitably cause a good deal of mechanical damage, some of which may result from compression of the soil above and around the developing tubers, but most of it will probably be due to direct injury to the haulm. In one of the few trials which have been carried out on the subject, losses of 1–4 tons per acre occurred *in the wheeling rows* according to the season, with an average loss of about 2½ tons per acre. These figures relate to the variety King Edward grown on a silt soil, and include both kinds of injury. The *total* loss will, of course, partly depend on the numbers of rows covered at one application. On the whole, the advantage is with the big machine because the damage done in the actual wheeling rows by an 18-row sprayer is probably not very much greater than that with the 12-row machine, and the proportion of rows affected is considerably less.

Low volume ground spraying

The low volume sprayer applying 15–50 gallons per acre at about 40 lb p.s.i. pressure is a comparatively light and inexpensive machine, usually mounted on a tractor. It is the only blight-spraying machine likely to be found as part of the normal farm equipment. If this is the case, a word of warning is necessary—before copper-spraying begins make sure that no trace of herbicide remains in any part of the outfit. Further, with this type of machine it is particularly important to keep the filters clean and to ensure that the nozzle apertures are sufficiently wide, otherwise spraying may be inefficient and much time lost because of blockages. The cover given by low volume sprayers is not quite as good as that obtained with high volume machines, but it is usually adequate; it resembles the high volume type of deposit in that the liquid wets the greater part, if not the whole, of the leaf area and tends to drain into the hollows above the veins and at the tips of the leaflets.

It might be thought that with these light machines mechanical damage would be slight, and this idea is probably true of actual wheel damage. But the passage of the machine—often mounted rather low on the tractor and without means of adjusting the boom height—may actually cause more serious haulm injury than the bigger high volume trailers with their higher clearance and adjustable booms. Here, too, the total loss depends on the proportion of rows damaged, and in this respect the low volume sprayer, which is unlikely to do more than ten rows at a time, compares unfavourably with a large high volume machine. Further, it is worth noting that a sprayer with too low a boom not only damages the tops of the plants in every row, but it fails to spray them.

It may be said, then, that the low volume sprayer, designed for applying herbicides, does a reasonably good blight-spraying job but, like many other dual-purpose machines, it is not quite as efficient as equipment designed for the single purpose.

Concentrate spraying by aircraft

The main advantages of this system are the avoidance of any mechanical damage, the speed at which the spraying can be carried out, and the fact that it can often be done when soil conditions are such that ground machines cannot be used. If it is carefully carried out, spraying from the air seems about as effective as ground spraying, but it is more likely that some part of the field will be missed from the air than from the ground. Even with markers, the swaths may not overlap as they should, while obstructions such as power lines may result in a strip being left unsprayed. Irregularly-shaped fields and those bordered by trees may also lead to unsprayed or inadequately sprayed corners and patches. Difficulties of this sort are more easily overcome by the helicopter, with its lower spraying speed, than by fixed wing aircraft.

In an open field, with no obstacles, there seems to be no difference in efficiency between the plane and helicopter; both can apply 3 gallons per acre and produce a reasonably uniform spray deposit. This differs from the deposit given by the higher volume sprayers in that much of it is made up of separate spots of fungicide, which usually dry quickly and do not coalesce. Since the blight control obtained is much the same as when the leaves have been sprayed to run-off, it is probable that the separate spots act as reservoirs of fungicide and that in wet conditions (when infection is likely to occur) enough copper spreads from them on to the rest of the leaf surface to inhibit germination of the fungus spores.

The two types of aircraft have about equal merits as far as speed of work is concerned. The fixed wing aircraft sprays faster, but takes longer to turn round at the end of each run; therefore the helicopter will usually be quicker over the smaller fields, but over larger areas requiring few turns, the fixed wing plane will have the advantage. The helicopter also gains because it does not need a prepared landing strip, but, on the other hand, it is handicapped by squally and windy conditions. Its one great disadvantage, however, is that it is very expensive to buy and maintain. The various types of fixed wing aircraft are all much cheaper than helicopters, both in initial outlay and maintenance.

Ground dusting

The conventional ground duster of the Gratton type is a comparatively light machine in action, especially as it has no water to carry, and is therefore likely to cause less soil compression per application than a wet sprayer. But it is generally conceded that one dusting is a good deal less efficient than one spraying; in particular, adhesion is not so good, so that the dust is easily washed off by rain or rubbed off by the contact of one leaf with another. The usual recommendation, therefore, is to give about five dustings to equal three sprayings, reducing the intervals between applications from about a fortnight to about a week. After taking into account the extra number of dry applications which would be necessary, it is probable that the total mechanical damage resulting from dusting and wet spraying respectively would be about the same. The need for more frequent applications is not altogether

without its advantages, however, because the new (and vulnerable) growth which is being continuously produced is covered earlier in its existence, and so rendered less susceptible to attack.

The material usually applied by ground dusters is a Bordeaux type dust containing about 20 per cent copper; applications are generally of the order of 15 lb per acre. This means that the equivalent of about 3 lb of metallic copper is being applied on each occasion (rather more than would normally be applied in a wet spray). When it is remembered that nearly twice as many applications will be made, it is clear that dusting is comparatively lavish in its use of fungicide material.

To get maximum adhesion, dusting should be done when the leaves are wet, and therefore it is usual to dust as soon after dawn as possible, or even during the night, when the leaves are wet with dew. Another reason for dusting at these times is that air-turbulence is then at its minimum. These factors, of course, affect spraying of all kinds, but they are likely to be of greater importance with dusts than with sprays.

Pros and cons

It is apparent, then, that all the methods available to us have advantages and, all told, there is not much to choose between them. For the farmer who grows a few acres of potatoes and already has a low volume sprayer, this is the obvious answer, though the possibilities of one of the drift methods should not be forgotten. If farmers with small fields in hilly districts can see these techniques in action they would be well advised to do so, for it is possible that they would find them particularly useful; in many cases much of a field might be sprayed or dusted from the headlands with very little mechanical damage to the crop. Frequent treatments might be necessary, but this is no drawback when the application methods are so quick and easy and, as has already been mentioned, frequent applications are certainly desirable from the purely technical point of view.

For the large-scale grower, the high volume sprayer, the duster and the aircraft can all do excellent work. It is noticeable, even within one potato-growing district, that although many farmers have strong preferences for one method or another, the individual preferences cancel one another out when the district is considered as a whole. The outside observer can only conclude that all the methods are about equally satisfactory and that failures, when they occur, are more likely to be due to unfortunate timing of the spraying, or to bad operating, than to the demerits of the particular spraying systems concerned.

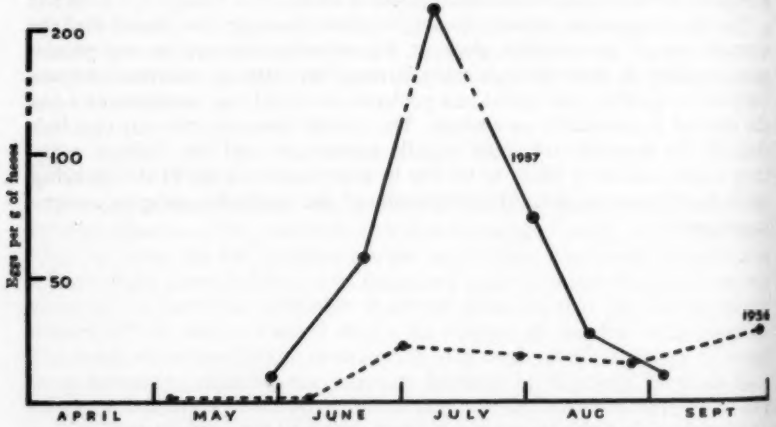
Nematodirus Infestation in Sheep

C. R. W. SPEDDING, M.SC., PH.D.
The Grassland Research Institute, Hurley, Berks

The losses caused by *Nematodirus* can be greatly reduced by taking simple precautions in the management of pasture used for lamb rearing, for it is on such grazing areas that the heaviest infestations of the parasite occur.

IN recent years infestation of lambs with *Nematodirus* spp. has caused appreciable losses, particularly in Scotland[1] and the north-east of England[2]. At the Grassland Research Institute the pattern of infestation with *Nematodirus filicollis* has been investigated during the past three years, with a view to obtaining control of the parasite by pasture or grazing management, and this article is a summary of the results of the inquiry.

Lambs normally acquire infection by ingesting, on the herbage they eat, infective larvae which develop from eggs passed in the faeces by lambs of the previous year. The number of eggs passed by ewes is usually negligible and, where a ewe flock has been present for some years, may be ignored as a source of significant levels of infestation. Nevertheless, where ewes are introduced to clean land the few eggs they pass may initiate the infection, either by infecting the following year's lambs directly, or by infecting the current year's lambs to a degree which is too low to affect the animals' growth, but is high enough to cause the depositing of sufficient eggs on the pasture to produce a considerable infestation in the following lamb crop. It follows then that on initially clean land, *Nematodirus* infestation *can* build up to serious proportions in two years and this is illustrated in the following graph.



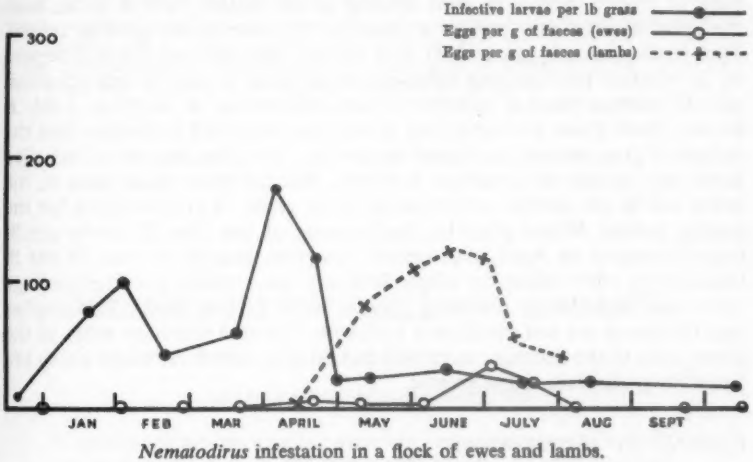
Nematodirus infestation of lambs in two successive years on the same pasture.

The original infection may be introduced by bought-in tegs and is likely

to be more serious if the tegs are grazed in the autumn on pastures intended for lambs in the following year. But whatever the source of infection, a serious level of infestation is not likely to develop unless lambs are grazed on pasture that carried lambs in the previous year.

The pattern of infestation

The pattern of infestation with *Nematodirus* is relatively predictable. The following graph shows the normal course of events for a ewe flock with spring-born lambs. The ewes pass comparatively few eggs; the lambs may pass considerable numbers, the majority of which are deposited between mid-May and mid-July. This period is related to the age of the lambs—for those born in February the egg-count peak would probably be earlier, whereas for the April-born lambs it would be later.



Nematodirus infestation in a flock of ewes and lambs.
(Mean for 1956–7.)

Re-infection within the same year appears to be unimportant: the lambs merely pick up the residual infection from the previous year. Thus the number of infective larvae on the grass may remain low during the summer and autumn, but increase rapidly between January and May. The above graph shows the infection peak in late March, but the conditions which determine the time of maximum infection on the grass are far from being fully understood. In some cases, where late autumn grazing with lambs has infected a pasture late in the year, the peak on the grass in the following year has been delayed until June or July.

The amount of infection picked up is primarily related to the amount laid down in the previous year[3]. However, there are indications that even an infected pasture may be grazed in ways that lead either to maximum or minimum infection of the lambs. During 1956, a three-acre paddock sown in rows of several different grass species was grazed periodically by ewes and lambs at times when the lambs were passing considerable numbers of *Nematodirus* eggs. It is possible that the faeces of these lambs were dis-

tributed in a non-uniform manner over the sward, but there was no evidence of this. In February 1957, estimates of the number of infective larvae of *Nematodirus* per lb of grass were carried out on this pasture. The results are shown in the following table for three species sampled at the same time on the same day.

Number of *Nematodirus* larvae per lb of grass

	Red fescue	Cocksfoot	Timothy
Duplicate counts	16	28	60
	24	44	80
Mean	20	36	70

Some of the differences in the counts found between species could be related to the varying amount of herbage growth present and it is not intended to suggest that infection is necessarily worse on one species of grass than another, although this is, of course, possible, because the individual habit of growth must have some bearing on the matter. It does seem, however, that a sward may present a mosaic of infection to the grazing animal. Thus lambs leniently grazed may pick up less infection, but this will depend on (a) whether their grazing behaviour leads them to take in less infection, and (b) whether there is uniform vertical distribution of infection. Little is known about these problems, but it has been observed at Hurley that the volume of grass present is of great importance. If a given number of infective larvae are present on a pasture, it follows that the more grass there is, the fewer will be the number of larvae per lb of grass—a critical figure for the grazing animal. Where grass has had a count of less than 20 larvae per lb from November to April, the number has risen sharply to over 50 per lb immediately after cutting for silage. Similarly, the numbers per lb of herbage have risen immediately following grazing with cattle or sheep. This implies that the larvae are not distributed uniformly, but that there are more in the lower parts of the herbage: more will be taken in, therefore, where sheep are forced to graze close to the ground.

Control by management

There are three aspects of control by management in relation to *Nematodirus* infestation. The first is the complete avoidance for lamb production of pasture that carried lambs in the previous year; where this is possible, trouble is unlikely to occur. Second is the avoidance of the most heavily infected areas which will be the pastures that carried lambs 1–4 months old in the previous year. If it is possible to confine one year's lambs to a specific area of pasture, the problem of avoiding heavily-infested herbage in the following year will, of course, be partly solved. In fact, any method of alternating the areas used for lamb rearing will help to prevent serious infestation. The pasture not used for lambs can be utilized safely by older cattle or sheep, or by cutting for conservation. The third aspect concerns the measures which can be taken when there is no choice but to graze the lambs on a heavily-infested pasture. Only tentative suggestions can be offered as yet, but the evidence available points to the possible advantages of lenient grazing by lambs on long grass, followed by complete defoliation by resistant stock. In this case, *long grass* means the maximum quantity of herbage consistent with the quality required to enable the lambs to grow satisfactorily.

The precise height of the desired sward will depend upon its botanical composition. Lambs grazed ahead of the ewes (as in forwards creeping) on long grass would acquire relatively few *Nematodirus* larvae, whilst the following ewes would destroy large numbers with no ill-effects. Similarly, ewes and lambs could graze lightly ahead of older cattle or sheep with the same result.

A combination of these methods should give a valuable degree of control and there is every indication that the benefit would be cumulative; control in one year means less infection on the pasture in the next year, thus leading to a progressive improvement.

Thanks are due to Dr. William Davies for facilities to carry out the work on which this article is based and to Mr. T. H. Brown and Mr. I. A. N. Wilson for assistance throughout the investigation.

References

1. Lamb Losses from Worms: *Nematodirus* Infestation. J. T. Stamp, A. M. Dunn and J. A. A. A. Watt. *Scottish Agric.*, 1955, **34**, 213.
2. Some Observations on *Nematodirus* Disease in Northumberland and Durham. R. J. Thomas and A. J. Stevens. *Vet Rec.*, 1956, **68**, 471.
3. The Epidemiology of *Nematodirus* spp. Infestation in Sheep. C. R. W. Spedding, T. H. Brown and I. A. N. Wilson. *Vet Rec.* (in press).

Mechanical Cleaning of Cowsheds

T. J. Witchell

Lackham School of Agriculture, Wilts

A method which saves time and straw and, moreover, takes the backache out of cleaning cowsheds, will have a wide appeal. The equipment made at Lackham is comparatively simple and cheap.

The problem of removing the dung from cowsheds on farms where the cattle lie in through the winter months seems to have received little attention from engineers and cowshed designers. There are, of course, very expensive systems such as an endless scraper device fitted to the dung channel, overhead rail tubs and, where the cowshed is large enough, a central channel sufficiently wide to allow the passage of a tractor with scraper attached. There must be thousands of farmers in the same kind of situation as ours at Lackham, where we have a long cowshed housing thirty cows and no provision for a tractor to pass through the building. We were worried about the excessive amount of straw used for litter during the winter, and by the fact that before the cows could enter the milking parlour a considerable time had to be spent washing their hindquarters. This operation was necessary because the cows fouled their bedding, and if the matted dung was not disposed of fairly quickly it became difficult to remove.

Before we adopted our present system, the procedure was to load wheel-

barrows and take the dung outside into a corner of the yard; then when the size of the accumulated heap warranted it, tractor and fore-loader moved the stuff elsewhere. All this, of course, entailed a backaching job on slippery surfaces for two periods of about twenty minutes a day. Also, before the dung could be removed the good litter had to be retrieved from the dung on the actual standings. It was this salvage operation that constituted the main problem. For some time the herdsman had experimented with an electric wire above the cows' backs. In the early stages the wire was suspended in a rather crude fashion, but results were so promising that we had special brackets made which allowed the wire to be adjusted both vertically and horizontally, to get the best position.

A cow arches her back to dung and urinate, and provided the electric wire touches her in the right place, she will step back in the gutter so that the dung and urine are deposited where it can be removed mechanically. The dung must fall in the channel away from the litter if full benefit from the mechanical scraper is to be obtained. The cows become accustomed to the wire within a day or two and then step back automatically; in fact, they become "house trained", and the current can then be switched off. We have been asked if the width of the standings, or the length of the ties, added to the length of the cow herself, have any effect on the cow stepping back. In our experience these factors have no bearing on the matter; the action of the cow is dictated only by the position of the wire across her back. It is important, of course, to set the wire to make her step *backwards*, not forward.

Mobile power-driven shovel

Our next problem was to make a mechanical scraper. We thought of constructing one with a long T handle, which, by means of a wire and a windlass fixed at one end, could be pulled through the shed. But two men would have been required to work this device, and there was also the disadvantage that the wire dropped in the dung. Finally we decided that all requirements would be met by a power-driven shovel which, being mobile, could also be used for yard scraping and other jobs.

This machine was made in the Lackham workshop. It consists of a steel plate chassis through which passes an axle, and on this there are two free-running, pneumatic wheels (16 × 4 inches) and a fixed large-diameter, three-groove V-belt pulley. The engine is mounted centrally over the axle and has a gear reduction on its pulley shaft, making it particularly suitable for the cowshed-cleaning job. Incidentally, we use the same engine on a bale elevator during haymaking and corn harvest. It was quite easy to fix an engine bedplate on the scraper identical with the one on the bale loader, thus enabling the engine to be changed over in a matter of minutes. The drive from the engine to the axle is by three V-belts operated by an "in-and-out" jockey pulley. The trouble caused at first by wet dung falling on the V-belts and making them slip was overcome by fitting simple wheel guards. The pushing power of the engine is such that the dung in the whole length of the channel can be disposed of in three stages, the operation taking five minutes with one man only operating the machine.

The weekly consumption of petrol is half-a-gallon and one V-belt had to be replaced once during the winter. Expenses for upkeep are therefore

negligible. We found from experience that a curved blade on the front of the machine is not really the most efficient, because the dung is inclined to adhere to it. A slightly concave blade would give better results, and it would, of course, be easier and cheaper to make.

A device which might be useful in many cases is a ramp at the end of the shed, so that the loaded scraper could be run into a suitable position for unloading into a waiting spreader.

Scope for further improvements

After using our new system throughout a winter, we have proved its worth in several respects; for instance, we used 20 per cent less straw, and at least half an hour was saved per day because the cows remained cleaner and only required brief attention with a brush before entering the milking parlour. Less water was needed to wash down the channel, and the time taken for cleaning out the cowshed was reduced by a quarter of an hour. Not least of the merits of the system is the fact that the dairy staff and our students are very happy using it, and with their co-operation we hope to continue our experiments in this field of operations.

We feel we have only touched the fringe of the problem of easing the burden of our herdsman and his staff. It seems that the arable farmer is well catered for by having the most up-to-date machinery at his disposal, but we think that there is still scope for helping the small dairy farmer to reduce expensive labour costs. At the moment, we are trying out a small electric wire device to discourage the cows from lingering after leaving the milking unit. They do this in the hope of stealing concentrate from the hoppers, and as a deterrent the herdsman has fixed a wire which, when lowered, just touches the backs of the cows giving a gentle incentive to move on. Although this is still on trial, it has already given promising results. We are also working on a machine for cleaning concrete yards. One worthwhile method which we have already tried and proved is the partitioning of the collecting yard by an electric fence so that the dehorned cattle are confined to a small area. This prevents the whole yard from being fouled and saves considerable time and labour.

Britain Host to the World's Dairy Industry

The XV International Dairy Congress will be held in London from 29th June to 3rd July, 1959. Her Majesty the Queen has graciously consented to be Patron, and H.R.H. Prince Philip, Duke of Edinburgh, has kindly agreed to be President. Over 3,000 delegates from all parts of the world are expected to attend.

The Congress will be the most important and interesting event of its kind in Britain for many years, and all those concerned in any aspect of the production, distribution and manufacture of milk or in dairy science and technology will, it is hoped, attend. A booklet which gives the first details of the event is available in English, French and German—the three official languages of the Congress. Copies can be obtained direct from the Organizing Secretary, Mr. A. W. Marsden, at XV International Dairy Congress, 86 Brook Street, London, W.1, or through the International Dairy Federation National Committee or other recognized authority in each country.

Hedges in the Right Place

CHARLES FLOYD
Melksham, Wilts

Farmers and landowners are sharply divided upon the question of hedges. Post-and-wire may be a simple answer, but Col. Floyd writes convincingly on the superior value of well-kept natural hedges.

MOST readers of this JOURNAL will be familiar with the Ministry's June 4th crop return. It covers over thirty main crops and nearly as many kinds of vegetables. A visitor to one of our great agricultural shows may find classes for a dozen different breeds of horses, about twenty breeds of cattle, thirty of sheep and ten of pigs. Such is the diversity of British agriculture. Our field boundaries are no less various. At the north-eastern corner of our Islands solid sandstone slabs are used to break the force of the bitter gales which tear across the bleak fields of Caithness, while in the south-west, a New Zealand shrub is grown in tall hedges to shelter the early flowers of the Scillies. Each area has its traditional field boundary developed by local crafts. The long walls which cross the Galloway hills are made of great round boulders larger than a man's head, but just as skilful is the building of the dry stone walls of the Cotswolds from quite small oolite flakes. There is, however, one type of field boundary which is particularly English—the thorn hedge of lowland England. It is about the disputed future of these hedges that I wish to write.

Fine, well-kept hedges are to be seen in eastern Scotland and elsewhere, but it is on the loams and clays of what might be well described as Saxon England that the thorn hedge is most widespread and still to be seen at its best. It is over this same wide area that the challenge of the cheap wire fence, either barbed or electric, is most insistent.

Most farmers know to an acre the size of their farm, but how many know accurately the total length of their fence line? In this district of west Wiltshire we have about thirty miles of fence per thousand acres or, say, seven-and-a-half miles for a 250-acre farm. Modern practice encourages alternate husbandry which involves the grazing as well as the arable cropping of most fields in turn. Stock-proof fences are therefore one of the most important items of capital equipment and the cost of their maintenance a substantial figure in the profit and loss account.

Merits of the thorn hedge

Less than a hundred years ago Richard Jeffries wrote, "The billhook is the national weapon of the English labourer"; today, he might have substituted "grant-aided bulldozer" for "billhook". But before the forms are filled up and the contractor called in, let us consider the merits of a well-laid thorn hedge. First, on suitable soil a regularly-laid hedge is very long-lived indeed. Many of those we see today date from the time of the great eighteenth-century enclosures, and have therefore lasted nearly two hundred years. How

often will the newly-erected wire fences have to be renewed over a similar period? Secondly, a well-laid thorn hedge grown from the bottom is proof against all classes of stock, even the active old ewe. Thirdly, the hedges and the trees they support offer shade in summer and shelter in winter, and even some protection from heavy ground frost. Where do we find the bunch of stores on a cold January night or on a blazing summer day? Snug under the hedge, or pacing the wire fence trying to get out of the wind or away from tormenting flies. This is not just sentiment, for the lost flesh must be made up ultimately in the cost of feeding. Finally, there can be few dairy farmers who have not at some time suffered from the ills of grazing milking cows exclusively on new leys. It is to the remnants of the old pasture and the herbs that the hedgerows shelter that the old cows go for what they want.

The greatest criticism of the hedge comes from the arable farmer who sees a yard or two of weak corn on the north side of his hedge; but what he cannot see is his eventual loss of overall yield from a wide tract of land devoid of shelter. Many European countries have carried out detailed experiments on the effect of shelter-belts on crop yields, and the results of the trials (which should be much more widely known) are rather surprising.* In Jutland, increases varying from 6 to 34 per cent have been recorded, and German figures suggest a net increase of 15 per cent after allowing for the decrease on the small area in full shade. It is not suggested that hedges have precisely the same functions as shelter-belts, but the cumulative effect of their widespread presence or wholesale removal in exposed areas must be considerable.

In the primarily arable districts, a large field is required for the economic use of combines, whereas in stock-rearing areas smaller fields with more shelter are convenient so that stock can be sorted into groups by size and age, and a number of fields grazed separately and intensively. The electric fence is a useful device for strip grazing large arable fields while in ley, but it is costly in time and labour if employed for several separate groups of cattle scattered round the farm.

Value of good hedgerow timber

From the point of view of the economy of the countryside as a whole, the subject of hedges can hardly be separated from the question of hedgerow timber and we still spend £430 million on the import of timber every year.† Good hedgerow timber of the right species is an asset to the owner and the country, but bad, ill-grown timber full of wire is an embarrassment both to the owner and the home-grown timber trade. In their sample census of 1951 the Forestry Commission found that no less than 33 per cent of the standing hardwood in England and Wales was contained in hedgerow and park trees. Even more remarkable was the fact that half this great amount, estimated at 767 million cubic feet in all, stood within twelve southern counties of England—that is, in the area most typical of the thorn hedge.

---

* *Shelterbelts and Microclimate*. Forestry Commission Bulletin No. 29. H.M. Stationery Office, 1957. 17*s*. 6*d*. (by post 18*s*.).

† *Forestry, Agriculture and Marginal Land*. H.M. Stationery Office, 1957. 4*s*. (by post 4*s*. 3*d*.).

Hedge management

A proper understanding and knowledge of each district is essential to the good management of hedges, but a few general remarks may not be out of place. First, the hedge-cutting machine can be either the saviour or destroyer of our hedges, according to the way it is used. For cutting back outgrowth such as bramble, and for "barging up", the machine is ideal and will save many hours of costly labour. If, on the other hand, the knife is used horizontally to top a hedge a few feet from the ground the result will be destruction. The thorn will sprout from the mangled heads and the hedge will go hollow in the bottom. The next step will be barbed wire and the final outcome probably the bulldozer.

If fields are too small and two or more are to be thrown into one, I would, as a general rule, try and carry out the operation by removing those hedges which have an east-to-west alignment. These hedges will shade a crop on their north side throughout the whole day, while a hedge which runs north and south will not only give less shade, but allow each side to dry out as the sun goes round. This point is particularly important when considering the distribution of hedgerow trees, some of which may be felled and some left or replanted. The shade from a tree in the north-south hedge will always be moving, except just at the base of the bole. When hedgerow trees are grown they should be in small, compact groups and not strung out in long lines at regular intervals. The groups will produce cleaner, and therefore more valuable, timber and will not interfere with the run of the hedge. If there is a small gap under the shade of the trees, this can be filled by rails not nailed to the trunks but carried on stakes. The worst of all worlds is an over-shaded hedge with a single strand of barbed wire nailed to tree trunks at intervals. It is unlikely to be stock-proof and the wire in the trunks not only halves the value of the timber but, when grown in and out of sight, may one day damage a valuable saw or cause an accident in the mill.

Weeding, cutting and laying

If a hedge is due to be cut and laid it should, if possible, be done when one or both of the fields on either side are in arable. This will save the cost of temporary protective fencing against stock, which is essential in the first spring after laying. Perhaps the most important and difficult operation in laying an old hedge is the proper weeding before laying takes place. This cannot be done by any machine, but only by a man who knows his job. By weeding I mean cutting out unsuitable species. How tempting for the novice to bind the straight, pliable rods of hazel across a gap instead of grappling with the tough and awkward hawthorn! The hazel will surely die and leave a gap—not, however, before its heavy leafing in the first few springs has made the gap even bigger by shading out young regrowth of thorn.

It is not only the hazel which has to be cut out, but elder, field maple, dogwood, privet, spindlewood and wayfaring tree, to mention only a few of the commonest unwanted kinds. Maple, dogwood and wayfaring tree add much to the beauty of an old hedge, but they shade the thorn and leave weak gaps. They are very common on the chalk and may be partly responsible for

the fact that hedges on chalk country are usually poor, despite the ability of thorn to grow well on this kind of soil.

The weakest hedgerow plant of all is the elder, which is associated with rabbits; what a chance the present myxomatosis rabbit situation offers for reducing the elder! A hedge infested with rabbits will always grow elder in much the same way as rabbit-infested downs will grow ragwort. Both weeds are now on the decline and they should be attacked with all possible energy, like the rabbit itself, which is an enemy of hedges as well as of crops.

The whole value of a hedge lies in its thickness at the bottom. When it is laid it must be cut to the bottom to get the young growth in the right place; and when it is trimmed periodically, whether by hand or machine, the work should be done so as to keep the hedge narrow at the top and wide at the bottom. The sunlight can then reach all sides and overshade will not make the hedge go hollow in the bottom. Finally, no hedge can flourish when its roots are in a waterlogged ditch, with its sides covered with brambles, or when it is overgrown with creepers such as wild clematis, the countryman's Traveller's Joy or Old Man's Beard.

Complementary attributes

Space will not allow any consideration of the effect of hundreds of thousands of miles of hedgerows on the natural ecology of the countryside, and in any case the subject has yet to be fully studied. Hedgerows form a refuge for much of our vanishing native woodland flora and the insects, birds and small animals which the herbs and flowers support. But perhaps a word may be said about the birds. The commonest birds to nest in hedges, such as blackbirds, thrushes, hedge-sparrows, whitethroats and warblers, are insect feeders and the farmers' friends. When a hedge is tall enough for wood-pigeon or magpie to nest in, it is time it was cut and laid.

Finally, our countryside is something more than a food factory and dormitory for our vast industrial population. It is the home of our people, cared for and enriched by the patient work of many centuries. Natural beauty is always changing; and changes in the landscape there must be. But a country without hedges would no longer be the England we know.

Work Study in Farm, Field and Factory

On February 19 the Rt. Hon. Reginald Maudling, M.P., Paymaster-General, will open a conference on work study in farm, field and factory at 21 Tothill Street, London, S.W.1. The conference is being organized jointly by the Association of Agriculture, the British Institute of Management and the Institution of British Agricultural Engineers.

Quality Pears

B. D. NEAME
Faversham, Kent

Is it wiser to trust to the reliability of Conference than to the unrivalled quality of Comice? Is it worth while close-planting to encourage higher yields if doing so makes pest and disease control more difficult? When is the best time for picking pears? Mr. Neame's answers to these questions are based on his personal experience.

THE first essential in growing pears is a suitable site. Pears will grow on a fairly wide variety of soils, but for the best results they need a deep, fertile loam. The soil should be free-draining, but at the same time retentive of moisture, because transpiration losses are considerable, especially in a sunny summer which suits pears best. The site should be free of frost pockets and preferably on a sheltered slope. Frost, of course, can be extremely damaging, but cold winds in the spring and early summer have a most depressing effect on yields. Shelter is a necessity which can hardly be over-emphasized, although it may not be readily available.

The choice of varieties is not easy. Conference is grown more widely than any other variety. It is generally a good cropper, resistant to scab and acceptable to the public. No other variety can compete with it in reliability. Doyenné du Comice is far and away the best quality pear available to us, but experiences vary. In critical costings of established trees during the past five years on one farm, I have found Comice to be as profitable as Conference. It is, however, an irregular and often reluctant cropper, and probably not suitable for large-scale planting. It may be recommended as an alternative main variety.

Pollinators are desirable for Conference and essential for Comice. I know of no variety as profitable as these two, but believe that Hardy, Williams and Laxton's Superb are the best available pollinators. Conference is supposedly self-fertile, but benefits from one pollinator at the rate of one in nine, or better, one in six. Comice seems to need a larger selection of pollinators. Our practice is to grow Conference as a main variety with one subsidiary, but to grow Comice as a main variety supported by Conference and two other varieties, so that Comice represents half, or at most, two-thirds of the plant.

Hardy is a good market variety, not as reliable in cropping as Conference and difficult to market in perfect condition. Unless it is picked at the right time, it wilts and does not ripen to perfection. A large acreage should not be grown. Williams used to be avoided because of its susceptibility to scab, but with modern technique that need not be a problem. It is again one of the less reliable croppers and, although of good quality, its market value may be depressed by foreign competition. Laxton's Superb, which is even more subject to foreign competition than Williams, is a regular cropper, likely to be a bit small, but possibly the best pollinator for Conference; it is probably the least profitable of the varieties mentioned.

Conference can be kept in cold and gas store to prolong marketing until

after Christmas. Comice will keep well in cold store, but should be sold before Christmas; conditions for gas storage have been worked out, but I know of no commercial experience of such storage. Laxton's Superb has a short life, and Williams and Hardy are normally marketed without much storing.

We at Macknade grow a number of other varieties including Dr. Jules Guyot, Clapp's Favourite, Pitmaston Duchess, Bristol Cross and Fertility, but we are gradually discarding them, since they are either unsuitable as pollinators or unwanted on the market.

The pear plantation

Planting distances depend on soil, variety and the need for shelter. There is a conflict between quality and quantity. Close plants tend to give high yields, not only because there are more trees, but because of the mutual shelter that these trees give. On the other hand, pest and disease control is easier on wider plants and fruit tends to grow out better. Conference, a spreading variety, needs 20 or even 24 feet square. In the early days fillers are essential, although these should not be allowed to compete too drastically with the permanent trees. I believe that they should be gradually cut back before finally they are grubbed out. Comice, an upright variety, should be planted closer. Quince A is the normal stock to use.

The cost of establishing pears is high. Suitable land is expensive and £200–300 per acre is needed to bring trees into bearing. Further expenditure will be required to provide storage and packing facilities. Inter-cropping with soft fruit can be practised, but it is not generally beneficial to the pears; it may, in fact, be harmful and uneconomic because manurial and cultural requirements are different. Moreover, if trees are close planted, the cost of hand cultivation would be substantial.

While it is probably wise to plant trees in open ground, it is an advantage to grow established pears in grass. This is certainly more convenient for management and appears to help the general nutrition of the tree. A continually replenished supply of humus from mowings is desirable, and this can often mitigate the effect of mineral deficiencies in the soil. Although there is little evidence to show the precise effect of different types of sward on pear trees, I believe that a mixture of 10 lb of S.50 timothy and 2 lb of S.100 clover is best for East Kent conditions. Perennial ryegrass is too coarse and other grasses tried commercially give an inadequate amount of organic matter. Rainfall is a potent factor. Although Kent wild white clover is more persistent in field conditions, we cannot maintain it longer in our plantations than S.100, which gives more bulk.

The maintenance of a plantation sward is a continuous job, and mowing is troublesome but necessary. There is room for considerable improvement in mowers for plantation work, since their maintenance is expensive and time-consuming. I prefer the close-cut, gang-mown plantation to occasionally-cut long grass. Whether there is any economic advantage in this I do not know, but it is good for the morale of the grower, worker and visitor. There are various theories on the height at which grass should be cut and the height at which it should be left. Short grass is tidier and presumably transpires less. If irrigation is practised, transpiration should be no problem,

although the disposal of long grass may be. Four years' trial of irrigation on pears have so far failed to show any definite indication of increased yield on our deep soil. It would seem that the use of the Penman theory, which may be suitable for ground crops or tree crops on shallow soils, needs to be modified when dealing with fruit trees on deeper soils.

Manurial requirements of phosphate, potash and magnesium depend largely on local conditions, although there has been a tendency to use more phosphate than is necessary. Pears thrive on an ample supply of nitrogen. We usually use about 8 cwt sulphate of ammonia or equivalent, applied half in February and half in May. Growers should watch for trace element deficiencies. If the pH is at all too high, iron deficiency shows up widely. Its control and its economic effect need further study.

Fortunately, pears are normally less subject to pests than apples, but aphid, caterpillar, and tortrix have to be dealt with as routine. Red spider varies in importance, and generally speaking, pears are less affected than apples. Sucker, which can do considerable damage, is an increasing problem. Probably two sprays are needed in a season. We use nicotine at 8 oz per 100 gallons, with spreader on the first hot days before or after blossom, from white bud onwards. A second application is sometimes needed in early July.

Mildew is not yet a problem, although it has been reported on pears recently. Scab can be controlled satisfactorily by captan, and trees so sprayed show significantly higher yields than trees sprayed with mercury or sulphur preparations. Low volume spraying at 50 gallons per acre with airblast sprayers has been successful for several years.

Marketing pears

The date when pears should be picked needs finer judgment than is needed with apples. Pears must be picked some time before they are ripe to eat. Premature picking causes wilting and late picking may result in imperfect ripening or breakdown. There is a time when the pear can be separated fairly easily from the tree, and at that stage it should be picked.

Growing and picking pears is only a part of the grower's anxiety. Marketing is a complicated and perplexing business these days. The demand is clearly for a continuous supply of well-graded fruit. To make this available, storage and grading facilities are essential and preferably a large supply of fruit so that transport costs can be reduced by making up full lorry loads. The large grower may manage on his own, but the small grower must be prepared to co-operate with his neighbours.

The bulk of the pears grown in this country is sent from farms and packing stations to the wholesale markets, for distribution through the usual channels to the fruiterer's shop. There is, however, an increasing demand by large buyers for direct delivery from the pack house. This is a trend that the grower must watch, since it offers some significant saving in expense. There is also an increasing demand for pears for canning. Firm contracts with a price quoted to the grower offer certain advantages, if the price is reasonable.

Whatever form of marketing is adopted, the production of first-class fruit is essential. As in all other businesses, close attention to cost is vital. Traditionally, pears are picked into buckets or similar containers and tipped into

boxes or laid on trays. The picking and transporting from plantation to pack house is expensive and often damaging. Successful experiments in the bulk handling of apples have been carried out, and it should not be long before the same can be done for pears. Bulk containers can carry 20–50 bushels, according to design. Picking would be cheaper using picking buckets which release the fruit through the bottom into the container, so that there would be no waste of time and effort levelling off and stacking boxes. Transport also would be quicker and cheaper.

Costs could be reduced to some extent by further, or improved mechanization. Pneumatic pruning may come, and a machine to pick up and destroy prunings would be invaluable. These and similar introductions would reduce costs per acre. We must also seek to reduce unit costs by increasing yields. In this respect we need more knowledge of the workings of the fruit tree, possibly better stocks and new varieties, safe chemicals for spraying and more information on fertilizers.

Pruning plays no small part in the cropping capacity of pear trees, and modern technique has helped considerably in increasing the yield of some varieties.

The pear brought to maturity is an excellent fruit. It takes years of thought and care for the tree to produce its crop, and it is then the grower's job to ensure that the fruit is handled with due respect in the course of its onward journey.

Antibiotics in the Control of Plant Diseases

F. W. WEBB, N.D.H.

The Murphy Chemical Co. Ltd.

Much research work is in progress on the use of antibiotics to combat plant disease. Recent trials have shown that treatment with the antibiotic griseofulvin can not only give effective control of grey mould of lettuce, but also improve the size and quality of the plant.

SINCE the discovery in 1944 by Brown and Boyle[1] that a crude culture filtrate of the mould *Penicillium notatum* was effective against crown gall (*Agrobacterium tumefaciens*), the search has continued for antibiotics which will supplement the range of fungicides already available. The early use of antibiotics was confined mainly to those kinds known to be of value as bactericides; thus streptomycin has been used with considerable success in reducing losses caused by plant diseases brought about by bacterial infection.

Work carried out chiefly in the U.S.A. and New Zealand has shown that

one to three applications of a streptomycin spray containing approximately 0·005 to 0·02 per cent of active ingredient will give good control of stone-fruit blast (*Pseudomonas syringae*), fireblight of apple and pear (*Erwinia amylovora*), wildfire of tobacco (*Pseudomonas tabaci*) and bacterial spot of tomato and pepper (*Xanthomonas vesicatoria*).

In Great Britain, one of the most destructive bacterial diseases is bacterial canker of plums and cherries (*Pseudomonas mors-prunorum* and *P. prunicola*), and almost every cherry grower has experienced the keen disappointment of seeing his trees die just when they should be producing their first worthwhile crops. Experiments to prove the value of streptomycin for the control of this disease were begun at East Malling Research Station in 1954 and are still in progress. Crosse[2] has shown that streptomycin is of value in controlling the leaf phase incidence of bacterial infection, giving a better control than Bordeaux mixture as a spring spray, and a slightly better control as an autumn spray. Promising results have also been obtained in Scottish trials (sponsored by Glaxo Laboratories Limited) in which plastic emulsion paint containing streptomycin has been applied either by brush to the tree crotch, or as a spray to the whole tree as soon as the dormancy period has begun. Further trials are being made.

Streptomycin is not available to fruit growers at present; the use of medical antibiotics is restricted by law.

While most of the experience in the use of antibiotics has been gained with anti-bacterial types, some work has been carried out with other antibiotics known to be anti-fungal in their action. These include cycloheximide, helixin, endomycin, toximycin, antimycin and griseofulvin. The usefulness of some of these materials is limited by cost and the very narrow limits of safety between disease control and damage to the plant. Experience has shown that griseofulvin possesses marked activity as an inhibitor of pathogenic fungi in plants. Possibly the most interesting characteristic of griseofulvin is its systemic action; applied to foliage, this chemical becomes distributed throughout the plant including the roots.[3, 4]

Griseofulvin and Botrytis of lettuce

Napier, Turner and Rhodes[5] have shown that when griseofulvin was tested against forty economically important plant diseases, only five species failed to respond. Following this result, we began a series of trials to ascertain the efficiency of griseofulvin for the control of grey mould (*Botrytis cinerea*) in lettuce under glass. A few trials were undertaken during the 1955–56 winter, using mainly 3 per cent (active ingredient) griseofulvin dust. These preliminary trials proved so encouraging that during the following winter a further series was carried out on commercial establishments in the principal glasshouse areas in England.

Before describing these trials, one fact must be clearly stated: where cultural conditions are ideal—that is, where the soil/water relation is correct, plants are handled carefully and planted at the correct stage of growth, ventilation and temperature control are right, and meticulous hygiene is observed, *Botrytis* should not assume any commercial importance. It was because we had these ideal conditions that a number of the 1956–57 trials showed no benefit from the griseofulvin treatment: there just was no

Botrytis. In other instances, *Botrytis* damage was considerable and the benefit obtained from griseofulvin is set out in the following table:

Table 1

Results of trials with and without griseofulvin treatments

Trial	Type of glass	Treatment Dates		Date of planting	Date of cutting	Percentage Loss	
		Pre-planting	Post-planting			Treated	Untreated
1	Heated	—	9.10.56 24.10.56 27.11.56	—	12.12.56	21·0	40·0
2	Slight heat	14.9.56	26.9.56 11.10.56 6.11.56	17.9.56	12.12.56	4·3	7·2
3	Cold	23.10.56 7.11.56	29.11.56 14.1.57	9.11.56	13.2.57	9·6	15·3
4	Cold	—	13.11.56 18.12.56 22.1.57	—	11.3.57	25·0	34·0
5	Cold	20.10.56 17.11.56	5.12.56* 22.1.57*	21.11.56	26.2.57	8·5	16·2
6	Cold	1.11.56 27.11.56	1.1.57 5.2.57 8.3.57	21.12.56	1.4.57	11·0	26·0
7	Cold	22.10.56 7.11.56	28.11.56 18.1.57	14.11.56	27.2.57	7·0	11·5
8†	Cold Dutch light	8.11.56	2.1.57 6.2.57 6.3.57	24.12.56	19.4.57	6·0	9·0
9	Cold	—	5.2.57 27.3.57	30.1.57	19.4.57	2·2	7·0

* Soluble griseofulvin applied low volume. Less *Botrytis* on underside of treated plants.
† Crop attacked by downy mildew.

It will be seen from Table 1 that both heated and cold houses were used. In almost every case a 3 per cent dust was applied.

Comparisons were made between application of griseofulvin both before and after planting. A comparable area of lettuces was left untreated and used for control. The application rate of dust after planting was 14 lb per acre. The trial showed that applications of griseofulvin made both before and after planting gave a better result than when the pre-planting application was omitted. Where a pre-planting application was followed by two or three applications at approximately monthly intervals, the losses from *Botrytis* were reduced by about 50 per cent.

national as well as local importance, and they are often an extension of the work being carried out at the main research stations, with whom very close collaboration is maintained. Some experiments are duplicated at other horticulture stations, thus extending the range of soil and climatic conditions.

Fruit

At present there are 32 acres of fruit, but in time this will be increased to 60–70 acres for experimental work. In conjunction with the National Fruit Trials in Kent, newer varieties of promise are tested under a wider range of conditions. The Efford trials include dessert and culinary apples, strawberries, black and red currants, gooseberries and raspberries.

Special preparations for experiments later on include fruit plantings for work on pest and disease control, and accurately recorded and graded trees for critical experiments in which even small differences between trees might affect the reliability of the results.

Fruit nutrition is being studied in conjunction with Long Ashton Research Station on an area of over 20 acres of dessert apples and pears, black currants and strawberries. Various combinations and rates of fertilizer dressing are applied in order to produce plants of known nutrient status. Nutritional conditions in arable and grass orchards will also be compared. Experiments on strawberries include one on the effect of spring and after-cropping applications of fertilizers. Obviously, this whole programme is a long-term one and early results cannot be expected.

Heated glasshouse crops

At present the heated glass consists of 1 acre of vinery-type houses and ¼ acre of propagating houses, mainly of traditional timber construction. It is hoped to build houses for cucumbers and pot plants in the near future.

Hot-water heating systems and low-pressure steam are included in an extensive experimental programme on glasshouse micro-climate. The basic installation comprises two low-pressure steam boilers (total rating 5 million B.t.u's), fired by oil burners using 200 sec oil. The hot-water system is operated both by calorifiers and steam injectors. An instrument room is equipped with automatic recording machines, which can be connected by a permanently laid relay cable system to instruments operating in the glasshouses.

Very little is known concerning the various factors influencing the climate of glasshouses. For instance—what temperatures do crops need, are the heating systems commonly used in commercial glasshouses adequate, and how evenly is temperature distributed in the house? There are just as many unsolved problems of ventilation, and it is becoming evident that existing heating systems, ventilation facilities, and probably the design of glasshouses are far from providing the best conditions needed to give the fullest possible crop yields.

At the moment various methods of glasshouse heating, rates of ventilation, and the design of propagating houses are being tested, and some results have already emerged. One very detailed experiment concerned with the effect of small temperature differences on the growth, flowering and fruiting of the

tomato plant should help to determine just how close a control of the heating system is needed.

Correct supplies of water and nutrients are also key factors in crop environment. In working out a technique for precision watering, the loss of water from the soil, due mainly to leaf transpiration, is calculated and the deficit made good by a prototype irrigation equipment designed to give precise and even watering. A liquid feeding technique is included. The problem of soil deterioration is also being studied.

All this work occupies ½ acre of glass at Efford, and is being done in conjunction with the National Institute of Agricultural Engineering and Fairfield Experimental Horticulture Station. It is, of course, a long-term project and one of the most important on the station.

Much interest is being taken in the production of F.1 hybrid tomatoes. A noteworthy success in this connection is the variety Ware Cross, and each year the experimental horticulture stations, including Efford, test a number of such hybrids on behalf of plant breeders.

Frame and cloche crops

Experimental work covers crops grown in unheated structures, frames, and cloches, which are of concern to an increasing section of the horticultural industry. Approximately 1¼ acres of structure (static and mobile) and 1½ acres of frames and cloches are available at Efford.

Spring lettuce has naturally received a good deal of attention. Various methods of plant propagation, planting dates and spacing, and direct drilling *in situ* (as opposed to traditional transplanting) have been investigated. From the results it is now possible to advise more precisely on methods for obtaining satisfactory crops of lettuce for harvesting at given dates.

The best varieties and the rather critical sowing dates are subjects under study with the autumn lettuce crop in frames. Early strawberries in frames and cloches are a particularly important crop in Hampshire, and experiments include the testing of varieties for protected cultivation and the effect of method of propagation, size of plants, planting date and spacing on the earliness, yield and quality of the crop in both frames and cloches. It was necessary to build up virus-free stocks first for experimental use.

The effect of spacing on date of maturity and quality and its relationship to the level of nitrogenous feeding are being investigated on early frame crops of self-blanching celery. It has already become clear that closer spacing than hitherto practised—the most favourable appears to be 9 inches square—coupled with a fairly high level of nitrogenous feeding, will produce the earliest yield. It is important to realize, however, that once having matured, the crop must be marketed straight away, as deterioration is rapid at close spacings.

Experiments have shown Northern Cross and North Star to be the best varieties of sweet corn grown as a partially-protected crop. The effects of spacing and nitrogen level on the earliness and yield of cobs is being studied.

Melons, one of the few satisfactory summer crops for frames and cloches, are perhaps of greater importance here than farther north. Appropriately, therefore, Efford is testing varieties and studying various ways of growing and training the plants.

Unheated structures

Experiments on spring lettuce in frames have been repeated in structures, and have shown that to obtain a crop in time to permit early planting of the following tomato crop, planting is best done in mid-November at a spacing of 8 inches square.

A four-year experiment has just been completed on the spacing of cold-house tomatoes, using five spacings and three varieties. Slightly increased yields have been obtained from closer spacing, but insufficient to offset the increased production costs. The most economical spacing has proved to be 13,400 per acre.

Whilst experiments on the "bread and butter" crops—lettuce, tomatoes, and chrysanthemums—form the main programme, attention to alternative crops is not being neglected, particularly in connection with mobile structures. Devising profitable crop rotations and fitting the crops to the rotation timetable are subjects of particular importance with such structures.

Outdoor vegetables

The area given over to vegetable crops varies considerably, but about 50 acres are needed each year for experiments. Many questions of soil cultivation are still matters of opinion. For instance: does extra depth of cultivation give increased yield and justify its extra cost? Is the compression from continuous use of wheeled tractors really detrimental to soil condition? Can rotary cultivation satisfactorily replace traditional ploughing? A long-term experiment on methods and depth of cultivation has been devised in conjunction with a rotation of vegetable crops. Some trends are beginning to show, but years must elapse before conclusive results can be expected.

A number of aspects concerning nutrition of vegetable crops are being investigated to throw light on both problems and basic needs. There is, for instance, a trial of alternatives to farmyard manure for maintaining soil organic matter.

Long-term experiments have also been established to study crop requirements of the main fertilizer nutrients, the residual values of phosphates and potash in the soil, and the effect of soil pH on nutrient uptake. There is so little factual information to enlighten manurial practice, and therefore this work will be specially interesting.

Successful irrigation is not just a matter of how much water can be applied to a crop. Either too little or too much can adversely affect cropping, and the first need is to determine the optimum water requirements of a range of vegetable crops. The effect of water droplet size on soil condition is also being examined.

Work on the sorting out and classifying of vegetable varieties and synonyms and rejecting all but the most worthwhile ones is the responsibility of the National Institute of Agricultural Botany, but Efford and other stations co-operate in work on these lines with various crops. The testing of plant breeders' material and seed production of selected types is also being carried out at Efford, especially in connection with the hardier types of Roscoff cauliflower.

Virus diseases of early potatoes and winter cauliflower have figured

prominently in vegetable problems. Work on cauliflower mosaic showed that infection of young plants in the plant-bed is the most usual source of spread in the subsequent crop. The use of a "barrier" crop of corn reduces to very small proportions both plant-bed infection and the risk of widespread infection in the field.

An experiment on the insecticidal control of the aphid carriers of leaf roll and virus Y in early potatoes showed that economic control is practicable, and the grower can safely produce home-saved seed with its known advantage of extra earliness. A detailed cost study of "seed" production on these lines will be carried out in 1958.

Although Efford is one of the youngest of the stations, and time must elapse before the experimental programme can be expected to yield full results, enough has been said to show that the interests of all sections of the horticultural industry are being catered for on a broad front.

Points from the International Crop Protection Congress Hamburg, September, 1957

IN CANADA, iron or copper *Spraying of Wheat* at the three-leaf stage, before, with or even after the application of 2,4-D, has given more grains per ear, greater weight of grain per ear and per plant, and less head deformation than in wheat given 2,4-D alone. Evidence was also quoted showing that leaf-feeding dusts containing a mixture of trace elements plus 2,4-D increased yields of crops such as wheat, sugar beet, beans and potatoes. In general, for crops tolerant to 2,4-D, its use in conjunction with foliar applitions of minor elements seems capable of combining weed control and higher yields.

Sodium monochloracetate was mentioned as promising for weed control in kale at the 3–5 leaf stage.

IN BELGIUM, work with *Electrical Soil Heating* suggests that chicken wire buried at 2–2½ feet may be an effective and economic method of partially sterilizing soil and valuable in controlling eelworm in glasshouses.

IN HOLLAND aerial and ground equipment are being found equally effective for control of *Potato Blight*. There was virtually no difference in yields between the two methods.

A study of the chemical changes that take place in *Sugar Beet* infected with virus yellows has led Dutch workers to develop a test by which the virus infection can be detected in the plant before the leaves show characteristic yellowing. This is expected to be helpful in speeding up the work of selecting and breeding resistant or tolerant varieties.

IN GERMANY forty-three new weather stations erected last year are forecasting epidemics of *Apple Scab*. They are equipped with instruments to record temperature, rain- and dew-fall, and duration of leaf moisture. This network, which serves an area roughly 25 miles long and 6 miles wide, from individual stations not more than 2 miles apart, has already provided warnings of local danger periods which a central station would have failed to detect. The cost of installation, some £2,000, was borne by the growers.

Wild Oats: The Outstanding Problem

STANLEY A. EVANS, B.SC., DIP.AGRIC.

N.A.A.S. Liaison Officer, A.R.C. Unit of Experimental Agronomy, Oxford

Despite the progress of chemical weed-killing, the control of wild oats still eludes the laboratory. Timely cultural operations is so far the only effective answer.

THERE is a new attitude to cereal crops now that chemical weed-killers are available. Many farmers no longer regard them as "fouling" crops but as a means of reducing weed infestations because, by an appropriate application of a selective herbicide, most of the major weeds can either be easily killed out or so suppressed as to do little harm. But an important weed remains for which there is no chemical control in cereals—a weed which has become the outstanding problem. This is the wild oat. It is found in many areas throughout the world, and not least in the east and south of England.

Precise evidence on the competitive effects of wild oats is not plentiful, but there are records to show that wild oat infestations can reduce crop yield markedly—up to as much as 50 per cent in cereals. Loss of crop is not the only reason for wishing to destroy wild oats, for infestations can also increase the expense of singling sugar beet and other root crops. Most farmers rightly deplore the presence of wild oats on their land, but they often find difficulty in bringing them under control. A survey of wheat and barley crops bordering roadsides in the eastern counties in the last few years has indicated that more than one field in five is seriously infested with wild oats every year.

Differences between species

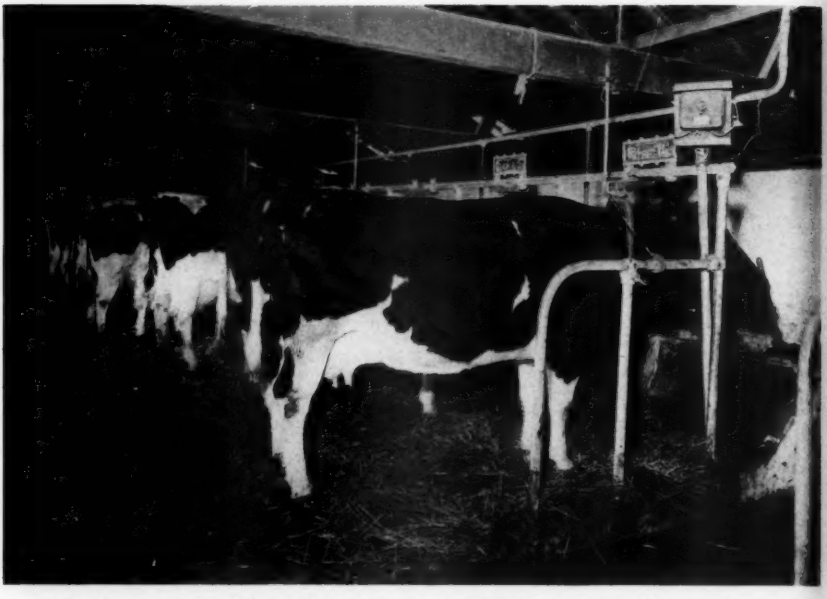
Two distinct species of wild oat occur in the British Isles. The importance of recognizing them is that their seeds germinate at different times of the year, and consequently the timing of the cultivations to control them must differ accordingly. The common wild oat (*Avena fatua*) is generally distributed throughout the arable counties of England. Although this species may, under some circumstances, germinate at any time of the year, it has a peak period of germination in the spring (March to May) and, again, but to a less extent, in the autumn (September to October). The second species (*Avena ludoviciana*) is restricted to the South Midlands and south-east of England. Its seeds germinate in the winter (October to February). There is little or no germination at any other time of year, hence the name sometimes given to it of the "winter wild oat".

In the vegetative stage, the two species are indistinguishable from each other and from cultivated oats, but they can be readily identified when bearing mature panicles. First, the mature seeds of the common wild oat fall to the ground individually, whilst in the winter-germinating species the two or three seeds of a spikelet remain attached to one another and fall together. Second, all seeds of the common wild oat have an "abscission" scar

Photo: *Bruce*

This crop of kale would have been less heavily infested with wild oats if propham or trichloracetic acid had been applied to the soil during the preparation of the seedbed, but the main weapons against the weed are still timely cultivation and hand-pulling.

Mechanical Cleaning of Cowsheds (Article on pp. 483–5)



An electric wire on adjustable brackets at a suitable height above the cows' backs makes them step back to use the dung channel.

Photos: *T. J. Witchell*

This power-driven shovel, built simply and cheaply in the Lackham workshop, clears the dung channel in five minutes and its use saves straw and water.

Antibiotics in the Control of Plant Disease (Article on pp. 493–7)

Except when grown under perfect conditions, lettuces may be damaged considerably by *Botrytis*. In a test, 34 plants out of 50 were infected.

Photos: *Murphy Chemical Co. Ltd.*

Botrytis damage may almost be halved if the lettuce are treated with griseofulvin before and after planting.

Hedges in the Right Place (Article on pp. 486–9)

A well-laid hedge with a good ditch. The sides of the ditch are not too steep, and there are no jagged stumps at ground level in which water can collect and cause rotting.

Photos: *Farmers Weekly*

A properly weeded and well-laid hedge needs only trimming each autumn to keep it stockproof. Young hawthorn shoots growing from the roots will keep the hedge thick at the bottom.

at the base where they have broken away from the rachis (stem) of the spikelet, but the second and third seeds of the winter wild oat have, when separated, a short stalk—the remains of the rachis—attached to them. Third, all the seeds of the common wild oat possess an awn, whilst the third seed of the winter wild oat, when present, possesses no awn. The colour of the seed and the amount of hair on them are too variable to be used to distinguish the species; but the fringe of hairs around the base of the seed distinguishes wild oats from the cultivated crop.

Build-up and prevention of infestations

Wild oats are, of course, annuals and arise each year from seeds. One plant can produce 200 or more seeds, many of which may be shed before the crop is harvested, and the presence of a few wild oats in a field can, within a few years, build up to a serious infestation if control is neglected. Of the seeds shed in the autumn, only a proportion will germinate, according to species either in the same autumn and the following spring or in the winter, and the remainder will lie dormant for a variable length of time. Seeds of the common wild oat can remain alive in the soil for three or four years, and probably longer under certain conditions (for example, under a ley). The seeds of the winter wild oat, however, seem to be rather less persistent. It is the reserve of seeds which can be built up in the soil which makes the task of eliminating wild oats difficult, and in view of this every effort should be made to prevent the introduction of the weed into the land.

On the farm the weed is introduced mainly from infested seed. So all seed should be very carefully inspected before sowing. The Field Approval Scheme for cereals, a voluntary scheme, allows only three wild oat plants per acre in a crop to be taken for seed; the Scottish Scheme allows none. But there is at present, no legislation concerning wild oats in agricultural seed. The Seeds Act, 1920, requires the buyer of seed to be given particulars as to purity, but it does not prohibit the sale of seed containing wild oats in any quantity, for wild oats are not included in the list of injurious weeds for which special provisions are made. The report of the Committee on Transactions in Seeds (published in November 1957 by H.M. Stationery Office) gives some prominence to the wild oat and includes it in a list of injurious weeds. Paragraph 77 of this report says:

> The inclusion of wild oat in this list recognizes its importance as a competitor with the crop in which it is growing, the extra cost and trouble of cultivation, the possible loss of value in the harvested grain, and the extreme difficulty, inconvenience and cost of eradication. We considered whether these factors would justify us in recommending that the sale and sowing of seed containing wild oat should be prohibited altogether.

The only reason which the Committee gives for not making this recommendation is the opinion that "the difficulty of eradicating the wild oat seed from cereal bulks obtained from infested land would mean that a prohibition on sale would unduly restrict the availability of seed"—which has a serious implication on the degree to which cereal seed is contaminated. Instead, the Committee recommends that seedsmen should be required to make a declaration of the numbers of individual wild oat seeds (and also the other "injurious weeds" listed) present in a sample of prescribed size. This, states the

report, would be a warning "to the farmer who already has clean land or is taking steps to clean it, and should do much to restrict further seeding from sources outside the farm".

Although unclean seed is recognized as the most serious source of infestation, other means of introducing and spreading it should not be overlooked. Threshing machines, combine harvesters, straw, manure, sacks which have been used for corn, and so on, may all harbour seeds of wild oats.

When the number of wild oats is relatively few before infestation has been built up, it is quite feasible and highly desirable to pull them by hand: removal of ears may not be sufficient where later tillers can produce further heads. The whole plant should be removed and destroyed. This can be done before harvest makes heavy demands on the labour of the farm and it can save a great deal of trouble in later years.

Cultural methods of control

The aim behind all control measures, beyond achievement of the immediate benefits of improved crop, yield, etc., should be to reduce and eventually eliminate the infestation. This means preventing seed from being shed each year in numbers that would maintain or build up the reserve of seed in the soil. One obvious way of securing this would be to put the land under a ley, during which time of course no wild oat seeds would reach the soil and those already there would eventually die. But how long the ley would have to remain down is uncertain, because the length of time wild oat seeds might remain alive under these conditions is unknown. It would certainly be not less than four years, and may well be considerably longer. Under arable conditions cultural control can be aimed at (1) suppressing the growth of wild oats by competition from crops, (2) destroying seedlings and germinating plants, and (3) preventing the shedding of seed.

Heavy competitive crops can reduce the incidence of wild oats, and to this end early sowing, adequate manuring and increased seeding rates can all play a part. Wild oat plants are particularly susceptible to smothering by vigorous crops when in the very young stage. The destruction of germinating plants of the common wild oat can be attempted both in the autumn and the spring. After harvest, light surface cultivations or shallow ploughing can encourage seeds to germinate and the young plants will be subsequently destroyed by the winter ploughing. In the spring it may be necessary to delay the sowing of a crop to allow time for a seedbed to be prepared and for the wild oats to germinate. A flush of young plants encouraged in this way will be destroyed in the final cultivation before sowing. Crops sown in May or later are likely to have few wild oats in them, as the main period of germination of the weed will have been passed.

The winter wild oat, because of its habit of germinating in the period October to February, is found only in autumn or very early sown spring crops because seedbed cultivations in the spring will normally destroy them. Thus a sequence of spring crops whose sowing need not be delayed after the beginning of March can considerably reduce infestations of winter wild oats; on the other hand, spring cropping cannot eradicate the common wild oat and may do nothing to reduce it unless sowing is delayed to allow the flush of wild oat seedlings to be destroyed.

In addition to cleaning operations before sowing the crop, row crops permit cultivations both before and after sowing. Some hand-pulling may be necessary in the rows. In a well-cultivated row crop, no wild oats should be allowed to seed. Another method of preventing seeding is to grow some crop, say arable silage, which will be removed from the land before the wild oats ripen.

In view of the main germination period of wild oats, a summer fallow will do nothing to reduce an infestation of winter wild oats and it may be little or no better than a late-sown spring crop in destroying the common wild oat. There is no means of destroying wild oat seeds in the soil, and they are capable of germinating from a depth of 8–9 inches under certain conditions. Stubble burning is unlikely to kill many seeds, and it may encourage more seeds of the common wild oat to germinate; on the other hand, it may induce dormancy in the winter wild oat. Deep ploughing has generally little effect.

Cultural methods of control, therefore, depend upon the adoption of a suitable sequence of crops, coupled with appropriately-timed cultivations, the aim of which is to exhaust the seed in the soil, mainly by destroying seedlings, whilst at the same time preventing any replacement of this seed from mature wild oat plants.

Chemical control

Herbicides have been tried to control wild oats in cereal crops, but none has so far proved sufficiently selective. Where wild oats have been reasonably well controlled, the crop has generally been damaged, but where no crop damage occurred the control of wild oats was usually poor. The only crops in which chemicals offer any means of control of wild oats are sugar beet, peas, and possibly kale and rape. Here trichloracetic acid and *iso*propyl N-phenylcarbamate (propham) have been used with some success. Both are used in a similar manner but there is the greater amount of information on trichloracetic acid which is, therefore, usually recommended: it is applied to the soil at 7–8 lb per acre during the preparation of the seedbed, and the crop sown a week or two later. To assist even distribution of the chemical throughout the soil, it should be sprayed on to level land, rather than plough furrows, in a medium or high volume of water, and worked in as thoroughly and deeply as conditions will allow.

Such a treatment appears to have no effect on sugar beet and, from more limited evidence, kale and rape. Peas sometimes suffer a yield reduction of up to 20 per cent, and one would tend therefore to use trichloracetic acid only where the infestation is severe. The nature of the surface of the pea leaf is altered by the treatment, and this makes the plant more susceptible to dinoseb sprays which subsequently must be applied at a reduced rate. The control of wild oats achieved depends on soil and climate and is never complete; on average, a 75 per cent reduction may be expected, but occasionally it may be as high as 95 per cent or as low as 40 per cent. Only germinating wild oats are affected by this treatment; it has no effect on the residue of ungerminated seeds in the soil.

The main weapon against wild oats continues to be appropriate cultural operations, and the worthwhileness of hand-pulling when the first few are seen cannot be over-emphasized.

Tusser: Farmer-Poet

THOMAS QUAYLE, C.I.E., D.LITT., M.A.

Even four hundred and more years ago farming journalism was not unknown. Thomas Tusser was one of the earliest and most notable exponents of the art, and for good measure, combined shrewd farming sense with a gift for rhyme.

ABOUT the middle of the sixteenth century, alongside the great Elizabethan masterpieces in prose and verse, much popular literature had begun to appear, including books written for the edification and practical instruction of the country gentlemen and yeomen farmers. Until then, there had been few books dealing with country pursuits and activities, but these few included such famous examples as the *Book of St Albans*, first printed in 1486 in that town; Walter of Henley's *Book of Husbandry*, originally written in the thirteenth century and circulated in manuscript for over two hundred years until printed about 1510; and John Fitzherbert of Norbury's *Book of Husbandry* (1523). All three, and especially Fitzherbert's treatise, apparently continued in steady circulation, until ousted by the works of new Elizabethan competitors, one of the first and foremost of whom was Thomas Tusser, the farmer-poet, who lived from 1525 to 1580. He was educated at St Paul's School, Eton, and Trinity Hall, Cambridge. Then after about ten years in a minor post at Court, he left London to farm at Cattawade in Suffolk (where he is said to have introduced the study of barley), and later at Fairsted in Essex. From Cattawade, in 1557 he published *A Hundred Good Points of Husbandrie*, which by about 1570 was "married" to *A Hundred Good Points of Huswiferie;* this in turn was revised in 1573 to *Five Hundred Points of Good Husbandrie*, and further extended in 1577 and 1580.

The immediate and lasting success of the book was due mainly to the fact that Tusser makes the way as easy as he can for his readers by writing in rhymed verse which lumbers along at a steady cart-horse pace which, even now, compels the modern reader to accompany it, willy-nilly. He was an inveterate versifier, and his practical farming precepts and instructions, as well as his personal thoughts and feelings, seem inevitably to find expression in rhymed couplets. Over and above his picture of the farmer's life of his day, Tusser can never resist the temptation to turn aside into rhyming digressions on thrift, virtue, religion and life generally, herbs and flowers for windows and pots, physic, envious and naughty neighbours, pity for the poor and needy, and many another topic. It is easy to understand why his book, as a practical manual of good farming and a perpetual fount of sound common sense and kindly humour, became and remained a best-seller. We may well imagine many a semi-literate farmer, poring over a dog-eared copy of Tusser in the dim gleam of a rushlight after a day of toil and sweat in the fields.

Tusser begins his farmer's year at Michaelmas, the usual date of entry, and he notes that the open-field farmer entered by custom on his fallows by the preceding Lady Day so as to get and keep them in good heart for his

autumn sowing. Tusser carefully details the work on farm, garden and indoors, month by month, often with a running commentary on ancient customs and superstitions, which is of great interest and value to the social historian. The country gentlemen and the yeomen and tenant farmers must have found it all good, useful, agreeable reading, whilst the epitome, or "abstract" as Tusser called it, which prefixed the commentary for each month, no doubt helped them to learn a good deal by heart. Thus in the December *Abstract:*

> House cow that is old
> while winter doth hold

becomes in the *Husbandrie* for that month:

> The housing of cattle while winter doth hold,
> is good for all such as are feeble and old;
> It saveth much compas (dung), and many a sleep
> and spareth the pasture for walk of thy sheep.

Tusser has no patience with the meanness and short-sightedness of many of his fellow-farmers who starved their cattle and their land. He reminds them in his January *Abstract* that:

> From Christmas to May
> weak cattle decay.

and emphasizes his warning in the *Husbandrie* with:

> From Christmas till May be well entered in,
> some cattle wax faint, and look poorly and thin.
> And chiefly when prime grass at first doth appear,
> then most is the danger of all the whole year.

From his own hard-won experience he knows that excessive carting *brings out of heart* both the land and the horse, that north winds are as ill to the hops as *a fray in a feast,* but that a south wind is a *joy* to them like a *welcome guest.* He keeps insisting that Nature must be given her way, *Let seed have her longing, let soil have her lust,* and he says bluntly that a bad farmer *defraudeth the land.* He was a thoroughly practical farmer, and the "boss" who saw to it that the work both indoors and out was done—*Show servant his labour and show him no more,* and *Maids up, I beseech you, lest Mistress do breech you.* Like the good farmer of all ages, he looks on his stock, not sentimentally, but with a real regard for its well-being:

> See cattle well served, without and within
> and all things at quiet before supper begin.

He looked after his men and stipulated that nothing should be *grudged* to sick labourers. His hard and suspicious overseership was tempered with kindness and charity. He knew that the best workers all the year round were those who *sing in their labour as bird in the wood.* He recommends higher pay for good work and no latitude for shirkers:

> Grant harvest-lord more by a penny or two
> to call to his fellows the better to do;
> Give gloves to thy reapers, a largess to cry,
> and daily to loiterers have a good eye.

The harvest-lord was a trustworthy labourer, knowledgeable and experienced in all kinds of harvest work.

The piety which shines forth from his pages is the simple faith of those who have to earn their daily bread by the sweat of their brows. There is no doubt, he says, about anyone's duty at any moment, and the character of others does not absolve us from our own plain duty:

> Though Vicar be bad and the Parson as evil
> go not for thy tithing thyself to the Devil.

He preached and practised true Christian principles, was kind to his neighbours, and ever generous and considerate for the poor and needy. He loved to keep up the old country customs:

> In harvest time harvest folk servants and all
> should make all together good cheer in the Hall.

For good measure at the festive season, he gives a poetic bonus in *A Description of the feast of the birth of Christ commonly called Christmas* and a *Christmas Carol*, as well as stanzas on *Christmas husbandry fare*, which was to include:

> Good bread and good drink, a good fire in the hall,
> brawn, pudding and souse, and good mustard withall,
> Beef, mutton, and pork, shred pies of the best,
> pig, veal, goose and capon, and turkey well drest,
> Cheese, apples and nuts, jolly carols to hear
> as then in the country is counted good cheer.

It reads like the Dickensian Christmas at Dingley Dell, with Mr. Pickwick and his good companions joining in the feasting and the revelry.

Tusser is not without importance for other aspects of our economic history. He was an unswerving supporter of enclosures, and his advocacy is all the more striking in that he was an Essex man who had farmed in Norfolk and Suffolk. At the very time when the agitation in the eastern counties was at its height, and soon after Ket's rebellion in Norfolk, he included in his *Husbandrie* a *Comparison between Champion* (*open*) *country and Several* (*enclosed*):

> The country enclosed I praise,
> the tother delighteth not me,
> For nothing the wealth it doth raise,
> to such as inferior be.
> How both of them partly I know,
> here somewhat I mind for to show.

And he goes on to claim the superiority of the enclosures over the open-field system:

> More plenty of mutton and beef,
> corn, butter and cheese of the best,
> More wealth and where (to be brief),
> more people, more handsome and prest (neat)
> Where find ye? (go search any coast)
> than there where enclosure is most.
>
> . . . . . .
>
> More work for the labouring man,
> as well for the town as the field. . .

Between 1557, when *A Hundred Good Points* first appeared, until the end of the century, no fewer than thirteen editions are known to have been published. But they are all scarce, and few of the extant copies are perfect,

surely a tribute to Tusser's work as a manual of practical farming, for the copies must have been kept handy for reference, and passed on as worthwhile heirlooms from generation to generation. Subsequent writers, such as Henry Best in his *Farming Book* (1641) and Walter Blith in *English Improver Improved* (1649), drew drafts on it, whilst David Hillman, in his abbreviated version *Tusser Redivivus* (1710), took the opportunity of comparing and contrasting Elizabethan farming practices with those of the early eighteenth century. In 1723, when Lord Molesworth was advocating the establishment of agricultural schools, he recommended that Tusser's *Five Hundred Points of Good Husbandrie* should be "taught to the boys to read, to copy, and get by heart".

Almost a century later Sir Walter Scott gave high praise to "its homely, pointed, and quaint expressions", whilst Robert Southey paid Tusser the compliment, as from one poet to another, of including him in his *Collection of English Poets* (1831). And the compliment was not without justification, for Tusser was something more than a useful old rhymer, a mere writer of doggerel. He had a steady and ingenious command of metre and a good ear. He is not without claim to inclusion among the pioneers, minor and modest, of the new English poetry that was soon to fill

> The spacious times of great Elizabeth
> with sounds that echo still.

Whilst his great contemporaries, such as Sir Thomas Wyatt and the Earl of Surrey, drew their inspiration almost entirely from French and Italian sources, Tusser's verse is as native and homespun as the clothes he wore. And through the tricks and turns of his versifying, with its acrostics, alliterations, and easily-remembered jingles, a gleam of authentic poetry occasionally glints, as when he writes:

> Seven times hath blustering March blown forth
> his flowers,
> To drive out April buds, by sea and land,
> For minion May.

Green Crop Driers' Convention

TOM BILLINGTON

The eighth Annual Convention of the Association of Green Crop Driers was held at Bournemouth on November 21–23.

AN enquiring spirit was much in evidence at the Royal Bath Hotel when the Green Crop Driers had their annual conference last month. It was noticeable both from the platform and the body of the hall. Obviously, there are many questions still to be answered in all parts of the industry. This applies to the growing, harvesting and drying of the crop, and to the chemical composition and nutritional factors of grass. This spirit culminated in a proposal to set up a development committee and a marketing council. The proposal will be considered by the Association's Council.

In his opening address, DR. W. R. WOOLDRIDGE, Scientific Director of the Animal Health Trust, said that before World War II research on grass was largely carried out from the point of view of close-textured pasture, and was little connected with food value for animals. It was during the war and in the years immediately after it that chemists began taking a specialist interest in the subject.

Problems of intensification

Labour costs had forced every industry to go in for intensification or greater productivity per individual worker, but this is not easy to do when you are dealing with animals. There are two factors which cause the greatest loss in animal productivity—disease and management. Poultry-keeping reflects the intensification of animal productivity. Today, the farmer keeps his birds in batteries or on deep litter and, as a result, can handle hundreds of birds rather than the smaller number he managed previously.

Intensification requires a knowledge of hygienic management. Automatic feeding, automatic supply of water and most of the buildings and batteries come under this heading, but the basic form of hygienic management is to prevent droppings of animals from infecting the food, and to stop one animal from breathing over another; in other words, to prevent diseases of the alimentary tract and respiratory system.

The nutritional side of hygienic management is exceedingly important. In the early 1920s it was the energy value of animal feed that was mostly considered. Today, we have reached the stage where our knowledge of minor nutrients is extending, and many more vitamins are known to be essential. The final stage will be a full knowledge of certain substances known as anti-vitamins and anti-metabolites, which are of no value in a positive way but have a negative effect. This means that although they are of no use to the animal in themselves, they can block the use of the proper substances by the animal.

What is good grass?

Dr. Wooldridge was not convinced that the results of feeding on good

grass have been fully appreciated. If you ensure that the soil of your pastures is properly fertilized and that the plants are highly nutritious and cut at the right time of year, then you are supplying your animals with the highest possible food value and uncontaminated food.

Speaking about animal diseases caused by deficiencies in the soil, Dr. Wooldridge said that metabolic diseases can arise from luscious grass which might be bolted by the animal. Paralysis of the rumen or bloat can be one result, and to ease this situation he advised farmers to add fibre to the ration or limit the time of grazing.

It is sometimes thought that the amino-acids present in grasses have an effect not yet fully understood. Grasses beneficial to the animal may contain harmful substances: for instance, a certain subterranean clover in Australia is of value to the feeding of livestock, but it contains oestrogen, which gives rise to calving difficulties and even to infertility. This is a question, he said, which scientists do not yet fully understand, and much more work is needed to be done on it. If he is to have balanced pastures, the farmer must know what constitutes *good grass*: for example, more research is needed on the question of fibre. Referring to the nutrients in dried grass, Dr. Wooldridge said that that product is generally regarded from the point of view of its carotene content, but amino-acids and the minor, unidentified nutrients are also present, and these are most important. More research work is needed on this aspect.

MR. R. O. DAVIES of Navenby, Lincolnshire, in his Presidential Address (read in his unavoidable absence) emphasized that dried grass should be valued on its amino-acid content. It contains the pigments such as carotene, xanthophyll and chlorophyll. The value of carotene as a precursor of vitamin A is well established, but more attention is paid to xanthophyll in the U.S.A. than in this country. This pigment is responsible for the colour of yolks of eggs and the shanks of poultry. Chlorophyll, the world's predominant vegetable pigment, is the green colouring matter of all green plants, and it is essential to the life of practically all plants. It is still necessary, however, to learn a lot more about its nutritional functions. Apart from carotene, dried grass carries other valuable vitamins which are not so much in the limelight, such as the important B_2 and pantothenic acid and others about which less is known.

Mr. Davies said there were many things we did not know about many foods, and this also applies to grass. What is known is that grass is the best of all livestock foods, and in this connection he quoted the case of some experimental feeding trials which had been carried out with dairy cattle. The milk from the group of cows receiving dried grass was the only sample in which the solids-not-fat content exceeded the legal standard of 8·5 per cent.

Dutch methods

DR. TJ BAKKER, the Netherlands Agricultural Attaché, spoke about the technique of green crop drying in the light of the special attention which it has received in Holland; the main object had been to reduce the cost and improve the quality of the product. Experience has led to the practice of wilting the grass whenever this was possible. There is, however, the problem

of whether the inevitable losses in dry matter, protein, starch equivalent and carotene incurred in wilting are of such an order that the saving in fuel loses its value. Usually the grass is cut in the afternoon, tedded later the same afternoon, and once or twice more the next morning whenever the weather permits. It is possible, he said, to reduce the moisture content from 82·9 to 64·6 per cent in thirty-six hours. Reduction of moisture from 80 to 70 per cent gives economy in drying of £5–£6 per ton. Under normal circumstances, the losses have been found to be around 5 per cent—a value of £1 5*s*. per ton. Dr. Bakker said that although these figures could only be taken as an indication, they showed it was worth while to practise wilting when crops and weather permitted.

A substitute for concentrates

Good quality dried grass can replace balanced concentrates. This was one of the conclusions reached by MR. C. D. RICKABY, Nutrition Chemist, N.A.A.S., in his paper, "The Feeding of Dried Grass". He said that low-quality, dried grass is a substitute for super-hay—that is, hay cut early and well made. High-quality, dried grass provides a balanced cereal diet. As a feed for cattle and ruminants, the fibre has a marked value; if the fibre is lowered, the butterfat content of the milk is depressed. "Dried grass is rich in certain vitamins," said Mr. Rickaby. "It has vitamin A in the form of carotene, vitamin B complex in the form of riboflavin, and pantothenic acid which is essential for poultry, and the vitamins E and K. It contains, however, very little vitamin D. It may be classed as a vitamin concentrate." Mr. Rickaby said it is sound practice to include anything from 2½ to 10 per cent dried grassmeal in rations. It has an excellent effect on the colour of eggs, cream and milk, and it is also rich in unidentified food factors.

Asked whether grass dried in any particular season of the year had a higher value than that dried at another time, Mr. Rickaby replied that it used to be assumed that spring and early summer grass had a higher value than that dried in the autumn. Evidence on this particular point is not very clear, but he thought that if the grass yields of the two seasons could be mixed, it would be advantageous. His advice was to feed spring dried grass to the high-yielding cows and the autumn dried grass to the poorer yielders. Dr. Wooldridge said that more research should be carried out into the question of the relative values of grass dried at different seasons of the year. He personally saw no reason why grass dried in the autumn should not have the same nutritional value as that dried in the spring.

The Smithfield Show

December 2–6, 1957

JOHN L. JONES

WE came to Smithfield through a swirling, misty countryside where trees and fences appeared and disappeared like ghosts, along embankments glittering with frost. In London the same mist had mixed with the smoke to form a thick fog—not smog, thankfully—and we set out for Earl's Court through a typical December murk.

On the two great metropolitan occasions of the farming year—the Dairy Show and Smithfield—the influx of country folk is large enough to register even among the great city crowds, and the broad stream of fresh-complexioned tweed-clad figures retained its identity right through to Earl's Court, where 74,012 visitors passed through the clicking turnstiles. Each year at Smithfield it seems the great aggregation of machines moves inexorably on to the ring and enclosures, compressing the animals into a shrinking area. But this must be merely an illusion, for this year's 1,647 animals constituted a post-war record.

Although the machines dominated the scene, it was the livestock that provided the drama. It began on the first day, when, from the expectant bovine ranks where genes and feeder's genius combine, from the imposing Highland cattle, the black and red polls, the hardy beasts from the wet Welsh uplands, from the numerous sleek representatives of famous county and regional breeds of all ages and sizes (but mostly one shape), the winnowing eye of Mr. Robert Adam drew out two beasts to contend for the coveted breed championship. For a time hopes ran high that a good little 'un would defeat a good big 'un. But once again the succession of Aberdeen-Angus victories at Smithfield was unbroken. "Prospect of Charterhouse Mathe", bred by Mr. Mathew Templeton of Kelso and owned by Mr. Thomas Mann from Cumberland, was set above the beautiful Shorthorn steer bred by Boots Ltd. and previously adjudged the Angus's superior at Edinburgh. For the remainder of the Show, except for parades and television appearances with his pretty twin chaperones, the Misses Kathleen and Marjorie Mann, the magnificent black polly with the small elegant head was probed and anatomically enthused over by thousands every day. He was a wonderful beast—bred, fed and shown in the best tradition of this great beef breed.

From the sheep pens, where despite their wool the animals looked cooler than the cattle downstairs, the pea-pod fleshy uniformity of the Stype lambs won for Sir William Rootes his fourth successive Supreme Championship. The lustrous Longwools, notably the Lincolns and Leicesters, made a contrasting picture. They may not represent the housewife's choice, but in their size, lustre and length of fleece they fulfil the ideal of their great improvers and cannot fail to bring a gleam to the fancier's eye. In the crossbred classes —most of our fat lamb today is from crossed breeds—the probing, prescient fingers of a judge visibly mindful of the housewife's choice and the butcher's need, gave the prize to a pen of Suffolk/Welsh mountain, underlining the

attractiveness of the breed from the Principality in this age of the lean, lightweight lamb. There was an exciting blend of old and new in the traditional produce of Dorset—a Champion suck lamb, and polled, from Mr. J. M. Lenthall's Dorset Horn flock. Most attractive to the eye and with much merit, were the decorative Black Welsh Mountains that posed like graven images in their pens. These are colour recessives bred pure and among the hardiest of breeds. They featured among twenty-four different breeds which, with thirty pens of crossbreds, made up about 600 lambs. As with the cattle, weight for age and speed of maturing were very much to the fore.

Over the whole livestock section, now open to the pressures of free choice and marketing, lay the economic shadow of the butcher's knife. This was particularly so in the pig section, from which Dr. John Hammond drew several of varying merit. Their bodies were "parcelled out" with coloured chalks to demonstrate the cuts that please the grocer and the housewife. He offered a masterly commentary on live and dead conformation and illustrated the unwanted shape with a representation of the heavy-shouldered wild boar. There were 146 pork and bacon carcasses on the hook, and premium honours went respectively to the Large White and the Landrace. (There were 59 beef and 99 lamb carcasses, the former topped by a yearling Angus/Angus-Shorthorn steer.) There was something of a Welsh renaissance in the winning of the Supreme Championship by a Welsh pair from Frilford Farms Ltd.

Meanwhile, above and around these tiny oases of livestock stretched the glittering tiered acres of the best and brightest in the British farm machinery industry. One would be hard put to think of any single aspect of modern farming where mechanical horse-power is not replacing muscle. Surely, nothing was missing from this display. At a time when Britain is one of the biggest tractor-exporting nations in the world, the range displayed was a heartening signal of confidence by our manufacturers, who may soon be competing in the European free market. Prince Philip, who spent an energetic two hours at the Show, showed great interest in both live and deadstock and visited a large number of the trade stands.

Small details remain in a welter of impressions: eager young farmers clutching a growing harvest of literature gathered from the stands; the veteran Yorkshireman—like so many more accompanied by his family on a three-day shopping spree in the capital—already pining for the air and altitude of his native Brontë moors; the spine-chilling call over the loudspeakers for a Mr. Blank, who was "wanted for the carcass section"; the reticence of the herdsmen when questioned about their methods of feeding a champion; the bucolic humourist who, appropriately enough, asked at the bar for a cup of real beef tea.

Twelfth National Poultry Show

SYLVIA LAVERTON

EVERY year the Poultry Show seems to get better, but really this isn't surprising for our poultry industry is both lively and progressive. This year there were more than 3,000 of the finest birds on show, competing in more than 270 classes for prizes worth over £2,000.

Nowadays skilful breeding and rearing give us table birds with a new look—more meat and less bone and offal. Packing and presentation, too, are receiving much attention, and the display at Olympia provided ample evidence of resulting consumer appeal. There was table poultry in magnificent variety, and the oven-ready birds were particularly attractive. Surely housewives must always prefer to buy poultry ready to cook. Indeed, many town-dwellers have never acquired the art of plucking and trussing a fowl, though visitors to the show had the opportunity of seeing how the job is done by watching forty Young Farmers display their talents.

Turkeys are traditional Christmas fare, but there is a move to popularize them all the year round. One of the drawbacks of these birds in the past has been their size, suitable only for large family gatherings. Deep freeze has changed this situation, however, and it is now possible to buy a turkey steak any day of the year.

On the trade stands, equipment and appliances of every kind required for poultry and egg production were displayed. Large-scale poultry-farming can make heavy demands on labour and there is therefore the same trend towards automation here as in other industries. At least four battery units were featured with automatic controls, pre-set time clocks being used to start and stop cleaning, feeding and watering operations, thus allowing the poultry-keeper rather more personal freedom than of old.

There was an impressive, double-decker deep-litter house of American design in which everything but egg collecting was fully automatic, and even this was made easier by the use of a trolley on an over-head rail. This model utilizes forced ventilation to remove moist air, which, it is claimed, enables more birds to be housed in a given space without incurring health risks.

But saving time and labour are aims common to all poultry producers, whatever the size of the enterprise. The competition run by the organizers of the show, for time- and trouble-saving ideas and appliances brought a shoal of entries—proof, if any were needed, that the ingenuity of British poultry-keepers continues to flourish.

The outstanding feature of the show was the number and variety of demonstrations. A complete packing station in operation, showing plucking, eviscerating, processing and preparing for sale, aroused much interest, as did demonstrations of broiler production, and stands devoted to work study and the economics of lay-out and design of modern poultry farms. A final look round the exhibition confirmed how much the industry owes to its research workers and what a compliment it has paid them in accepting and adopting their findings so readily.

Month in the Forest

J. D. U. WARD

Rhododendron control—Game—Tree seed orchards

THE most severe spells of frost normally occur in January and February, and while they bring tree planting activities to a standstill, they do offer the best winter opportunity for hauling heavy timber without damaging the track. With snow, comes the perfect chance to check whether there are still any rabbits in the area, but snow also means that unfenced trees, whether young or old, are more likely to be attacked by hungry rodents.

Rhododendron has become a problem in many woods. The common variety, so widely planted since about 1750 for amenity purposes and to supply undercover for game, has long been regarded as a nuisance. Experiments on the chemical control of *Rhododendron ponticum* have been carried out by the Forestry Commission,* but no really efficient *cheap* treatment has been found. Some chemicals seem to offer a certain degree of promise if applied in special circumstances, but the best way of controlling rhododendron is still by mechanical clearance using bulldozers, or tractor-mounted cutting or grubbing blades.

One of the worst faults of rhododendron in woods is that well-established thickets dominate everything else in the ground and lower shrub layers, and wholly prevent any natural regeneration of tree species. Clearance costs vary from £20 to £80 per acre, so the small owner would certainly have to think twice before undertaking such work, although if his land is included in one of certain Forestry Commission's schemes, it might qualify for a scrub clearance grant.

Rhododendron ponticum is not a very fast grower, but it is fiendishly efficient at natural layering, and also propagates itself by seed. Yet any attempt made to cut and clear rhododendron from a place within the public view almost invariably brings forth protests about "wanton destruction of beauty"; forestry authorities in the Dolgelley area were strongly, but quite unjustifiably, criticized in this way a few years ago. The best follow-up after any clearance is probably to plant some vigorous, fast-growing shade-thrower such as western hemlock, silver fir, redwood (in the south-west), Douglas fir, or even Sitka or Norway spruce, though spruce is not a fast grower.

Before the shooting season is over, it may be worth while mentioning that there are several kinds of shrubs of a less domineering nature than rhododendron which encourage game. For instance, there is *Leycesteria* (Elisha's tears), snowberry, privet, dogwood (*Cornus*), some barbary and cotoneasters which have considerable "pheasant-appeal". In small patches, and on suitable sites, willows, gorse and broom also have their uses for drawing and holding birds.

The whole relationship of game and forestry is a difficult one. For ex-

* *Forest Record No. 34.* H.M. Stationery Office, price 9*d.* (11*d.* by post).

ample, in Germany (and in many places in Britain) deer are a serious woodland pest; while there is a good deal of heart-searching on the subject, in many parts of Germany the deer and the sport they provide are so much valued that an expected loss of 10 per cent of the forest's potential maximum yield is tolerated. The deer-hunting enthusiasts would argue that forests should be "alive", that is, teeming with animal life, rather than mere "dead" timber.

In most private woods in England there is a strong tradition that the gamekeeper's interests have priority over the forester's, and this attitude can lead to a good deal of trouble. In ancient times, of course, a forest was simply an area reserved for the king's delight and pleasure and to harbour the animals which he hunted. In the nineteenth century, with the introduction of breech-loading guns and the increase of wealth, there was a great demand for intensive game preservation. This demand came at a time when forestry was at a very low ebb, and the keepers' gibbets hung with stoats, weasels and owls, which are all friends of the forester, were a significant indication of how matters stood. That position in reverse could be said to apply to some of the modern Forestry Commission plantations. But now the Commission is trying to establish what number of deer could be tolerated per 100 acres of forest rather than to promote a policy of ruthless vermin destruction. There should be no insuperable difficulty in getting good forestry and game preservation to work hand-in-hand, provided there is a general spirit of friendly give and take, and full agreement on the importance of exterminating rabbits.

During a brief visit to the Forest Research Station at Alice Holt, near Farnham, I was fascinated to see some of the work being done in the nursery in connection with genetics. Much of this work is on the establishing of tree seed orchards (several of which are already in existence) where forest trees are grown not as timber trees, but as "fruit" trees to produce seed. The seed thus obtained will form the foundation of the forests of the future. Grafting is, of course, an essential technique in this work, but there are other methods of encouraging early seed production, for instance by girdling, strangulation, root cutting or root exposure and tying-down of branches. Work is not restricted to the common species (though larch, beech and Corsican pine perhaps receive special attention); it includes such relatively rare hybrids as Leyland's cypress, which may prove to be the evergreen hedge-plant of the future. Resistance to disease is a quality sometimes as eagerly sought as speed of growth or perfection of form.

Farming Affairs

Talking about poultry

I came away from the National Poultry Show with two main impressions. The first was that while there were no outstanding or radical changes of policy, there were many refinements of existing trends and equipment. The second and, indeed, the over-riding impression, is that the move towards automation and/or mechanization is now in full swing. Here I found certain aspects of especial interest. One was the degree with which power is being applied to everyday work. I sometimes wonder whether we are moving too fast in this direction, for it is one thing to buy an expensive mechanized plant, and quite another matter to have the facilities, and above all the knowledge, for proper servicing and maintenance of it. This is a side that tends to be overlooked in the first rosy flush of a new purchase, but a wise buyer would, I am sure, insist on some guarantee period; I am personally in favour of an agreement with the makers to cover maintenance and service during the ensuing years. It is often possible to make such an agreement on an annual basis, and I have found this to the advantage of both parties concerned.

Again there is this trend towards mechanization of the small unit—for example, a 200-bird plant; undoubtedly this has some advantages, but I do feel that here we may be carrying things too far. With a very big unit, it may be that mechanization will result in less time being available per bird, and this is not always a good thing. If the trend is extended towards the small unit, then I think the poultry-keeper may lose one of his main advantages, which is of course the individual attention that he can give to his birds.

I was interested, too, in the developments in poultry-housing design. They favour the low-roofed house, which may be anything up to 30 feet wide. This results in a cheaper unit per square foot of floor space, but I should like to have seen more detail given to insulation and the mechanization of window opening, for both these points are closely related, especially where the windows are used as air inlets. After all, the glasshouse growers can open or close all their windows from one lever, and I see no reason why poultry-keepers should not have the same advantages.

Just now we are running into the really cold weather, and I had this thought in mind as I looked at the new, automatic, water-drinking units. Many of them are of good and interesting design and prices are not unreasonable, but I did wonder what would happen if they froze up, and how much damage would be caused when they thawed.

Another section of the Show covered packing materials in some detail. There was evidence that some firms are trying to produce units both for the wholesale and retail handling of eggs, and for table birds or even parts of table birds, in a way which should help the producer with his display as well as the normal problem of packing. I particularly liked a cardboard container for fifteen dozen hatching eggs which had been specially designed for the job.

C. T. Riley

Tractor sense

Traction is now only one part of the work of tractors which are fast becoming portable, self-propelled power plants. Much of the power provided by the engine is used directly through power take-off shaft or belt and is not transmitted through the wheels at all. It is as important to take good care of shafts and belts as it is of tyres.

In the case of power take-off drives, no harm must come to the driving shaft when the tractor turns a corner. If a tractor and trailed implement are to turn easily, the hitch point should lie mid-way between the two universal joints of the shaft. In a power-driven implement mounted on three-point linkage, the shaft must neither be able to come out of its sleeve nor press solidly against the far end of the inside of the sleeve, whether the implement is in work or lifted.

To prevent vibration, the yokes of the two universal joints on the drive must be on the same plane, that is to say, if the shaft is lying on the floor, *both* yokes should also be flat on the floor. If the shaft is run as straight as possible, it will be more efficient as a drive and less likely to break. In the rare event of a shaft coming apart, remember that the driven broken end may swing wide and injure the operator. Guards and shields on power take-off shafts should always be firmly in position while the outfit is at work to prevent clothing getting caught. Stop the power take-off drive before you dismount from the tractor, or at any rate don't attempt any adjustments until the power drive is out of engagement.

A tractor driving a stationary machine through a belt, must be held firmly in position to keep it from creeping along the ground towards the machine and slackening the driving belt. Place a heavy plank so that it is resting on top of the front tyre and is wedged between the ground and lower part of the rear tyre. Chocking in this way allows the tractor to move slightly through the elasticity of the tyre, and this flexibility in drive is helpful when the load is intermittent. On some tractors there is little room between the edge of the belt and the inside of the front wheel, and if the belt whips sideways it rubs the edge of the tyre. With the plank method of scotching the tractor, the plank can be allowed to overlap the tyre just enough to take the belt rub.

If a crossed belt is used, see that the fastener does not project beyond the width of the belt, because it may jerk the belt every time it comes round to the place where the two runs cross. With a rubber-tyred tractor on belt work, hang a chain from the tractor to the ground to provide an earth for any electricity generated by the movement of the belt.

When a tractor has to be used as the power unit for an emergency stand-by generator, it is advisable to use a leather belt with a cemented join sown with hemp or copper thread, because a belt with a peg fastener may produce a flicker in the transmission. When a belt has been joined by its ends being chamfered and overlapped, it should be put on to the pulleys so that the chamfered edge on the inside of the belt points in the direction of travel; then the run of the belt round the pulley tends to keep the joint closed.

Friction clutches for operating the drive to power take-off shafts and to belt pulleys should be put into engagement with as little slipping as possible. However, sometimes it is necessary to slip them just a little to help the

machine to start under load, and in this case, always let them come into full engagement as soon as possible. Whenever it can be managed, it is better to let the pulley be put into engagement with the engine running slowly and the machine not under load. Overload release clutches on driven implements should be kept in correct adjustment to disengage whenever a blockage in the implement causes a suddenly increased demand upon the transmission.

H. J. Hine

Trials with barley in Hertfordshire

The Hertfordshire experiments on cereals previously described in *Agriculture** were continued during 1953–56, this time using spring feeding barley—varieties Carlsberg, Earl, Freja, Herta, and Proctor. The trials, all on commercial farms, were designed to estimate the effect of nitrogen, phosphate and potash in the seedbed and of additional nitrogen in late May and late June. The standard dose of nitrogen was 0·31 cwt per acre (=1·5 cwt sulphate of ammonia or 2 cwt "Nitro-Chalk") which, following the practice becoming common amongst farmers in the eastern counties, will be called 31 units. The average dressing of phosphate (in each case applied by combine drill) equalled 2·3 cwt of 18 per cent super, that is, 41 units of P_2O_5. Where potash was used separately, it was broadcast by hand and, to allow for non-placement, the rather large amount of 2 cwt per acre (120 units) was applied.

There was a profitable response to seedbed nitrogen at all eleven centres, the extra grain per acre varying from 1·6 to 8·2 cwt (13 per cent moisture) and averaging 5·3 for 31 units. This is considerably above the average for winter wheat. Earl was well below the other four varieties; if this variety is omitted the average rises to 5·7. Barley is a crop which makes good use of nitrogen.

Extracting four centres on highly calcareous (chalky) soils and adding two centres from another series of trials on chalk soils, the average response to 31 units was 6·9 cwt, which suggests a more liberal use of nitrogen on such soils. This agrees with the experience of some farmers.

The response to a 31-unit top dressing at the end of May, additional to that given in the seedbed, was positive at seven out of ten centres, and for all centres averaged 2·6 cwt. This is about 50 per cent of the seedbed effect.

When the May dressing was doubled the effect varied from −7 to +8 cwt extra grain and averaged only 1·8 cwt. The low average was due to the disastrous lodging often produced by this heavy dose and cannot be recommended in practice.

Where plots which had had a May dressing received a further 31 units in late June there was an additional gain at eight centres, the average for all ten being 1·6. The average total return for the three dressings each of 31 units, seedbed, May, June, was 5·3+2·6+1·6=9·5 cwt. These successive increases agree well with those to be expected from the nitrogen response curve, and they suggest that the lower returns from the May and June dressings were not due to the time or manner of application, but to their being additional to the seedbed dressing.

Phosphate and potash produced only small increases, the individual effects being estimated at 1·0 cwt for P and 0·8 for K.

* Vols. 57, p. 1; 58, p. 208; 60, p. 233 and p. 328; 62, p. 267.

Samples of grain from individual plots were analysed for nitrogen, and crude protein calculated. Earl was the highest with 9·45 per cent, and Carlsberg and Proctor lowest with 8·8 per cent. At only one centre was the crude protein up to the 10 per cent given as the average for barley in the Ministry of Agriculture's Bulletin, *Rations for Livestock*, and that figure is probably a serious overestimate for modern varieties.

The percentage of *nitrogen* in the completely dry grain from the no-fertilizer plots was above 1·5 at six of the eleven centres. Seedbed nitrogen gave only a slight rise in protein percentage owing to the large amount of extra grain which it produced, and the small increases in yield due to phosphate and potash were, on average, just about enough to counteract the slight rise due to the nitrogen. Thus, the complete fertilizer in the seedbed had practically no effect on nitrogen in the grain.

The extra protein per acre from the seedbed 31 units was 0·44 cwt, which is 8·3 per cent of the extra yield, 5·3 cwt, and so could not have any appreciable effect on the percentage of crude protein.

The May top dressing gave practically the same (0·40 cwt) and the June dressing produced 0·64 cwt of protein. Averages for all varieties at all centres were:

	Nil	Complete fertilizer	May nitrogen	May and June nitrogen
Crude protein %	8·34	8·34	8·95	10·47

A fuller account of these experiments can be obtained from the Agricultural Institute, Oaklands, St. Albans.

H. W. Gardner

At the Farmers' Club

Work Study in Agriculture

Ways in which work study can contribute to agricultural prosperity were outlined by Lt. General Sir Thomas Hutton, Chairman of the British Productivity Council, at the Club's meeting on December 11th. He defined work study as "a system of analysing work in great detail, using well-established techniques, in order to apply knowledge, experience and common sense to the best advantage. It is intended to make work easier and to enable more productive work to be accomplished with the same or less amount of physical effort".

Work study is time-consuming and requires considerable training; thus it would be a waste of time for an experienced farmer to do this work himself. There is therefore a need for a new specialist—the agricultural work study man (or woman)—who can combine considerable training in the techniques and practice of work study with a good farming background.

General Hutton suggested that for most farmers the expense of employing a full-time expert would be out of the question, so some form of national work study service would be necessary. This might be provided, for instance, by the Agricultural Co-operatives as a service for members, by firms with farm advisory services, by private consultants, and through the N.A.A.S.

For many farm operations, such as milking, which are common to farming generally, it should be possible to suggest improvements applicable over large areas and to establish standard times for given conditions to be used as

a guide to efficient use of labour. Such widespread activities would imply the need for including work study officers in the advisory service, a system highly successful in Holland.

The need for extensive studies on individual farms might be met by a non-profit-making service set up by the industry itself, as in Sweden. This would be particularly valuable on larger farms contemplating major additions or improvements to buildings. "It is unfortunate, in my opinion", said General Hutton, "that the large sums available under the Farm Improvements Scheme are likely to be spent without being subjected to work study to ensure that the maximum increases in efficiency are obtained, at the minimum cost."

Inclusion of work study in reviewing and approving farm improvement grants would save both the Government and the farmer a lot of money, besides enhancing the efficiency and economy of the new projects.

For instance, a Lancashire dairy farmer planned to modernize and extend two shippons and expand his dairy herd from 36 to 40 cows. Local contractors quoted from £1,600 to £3,000 for the job, but as a result of work study a new plan was evolved. By using self-feed silage on a yard-and-parlour system and growing more special-purpose leys, he was able to keep 50 milkers and spare one man from milking to look after more pigs and poultry. The total cost was reduced to only £1,200.

On a Devonshire poultry breeding farm, two men tending 3,500 birds on free range were walking over 3,000 miles a year. Changes made following work study cut this by a third and released one man for four afternoons a week for other jobs.

Practical steps to further agricultural work study should include the establishment of training courses, practical demonstrations and pilot studies on individual farms, short appreciation courses for farmers, advisers and trade union officers, and, at an early date, the attachment of one or two fully-trained work study men to the N.A.A.S.

Used as an aid to good management, work study will play an increasing part in improving efficiency and profitability of farming, horticulture, market gardening, forestry and marketing.

Sylvia Laverton

Broiler houses

A new Fixed Equipment of the Farm leaflet (No. 31) issued by the Ministry (price 1*s.* 6*d.*) deals with broiler houses. Broiler production is one of the most intensive and concentrated systems of poultry husbandry yet devised, and so naturally raises problems of disease control, ventilation, insulation and heating of the building. The kind of building which is essential if good production is to be secured is described—successful adaptation of existing buildings is not easy to achieve. Siting of the house, with its longer axis in a north-south direction, is recommended to get the full benefit of the early morning and evening sun, and at the same time keeping it as cool as possible in the hottest part of a summer's day.

In Brief

PLANT FOOD AND PRODUCTIVITY

Mr. David Lowe, who, with his three brothers, produces farm crops, fruit, vegetables and flowers on 2,000 acres in Scotland, was talking to the Fertiliser Society last month about fertilizers and productivity. On one particular holding, because of uncertainty of tenure, no dung or compost has been used for twenty-five years. This land has been a market garden for a century and a half, and is still producing 40 tons an acre of celery and 15–16 tons of dressed leeks. Plant food is provided by yearly dressings of 12 cwt standard potato fertilizer and two applications of 3–4 cwt nitrate of potash per acre. Humus has been maintained by returning very large quantities of crop residues to the soil.

This, of course, is exceptional land, and normally Mr. Lowe advocates heavy dressings of compost supplemented by all forms of industrial organic waste and appropriate fertilizers. He quoted from a recent farm survey on fertilizer practice by the Edinburgh and East of Scotland School of Agriculture which has shown that while less farmyard manure is available nowadays, more fertilizers are being applied, and increasing use is being made of ploughed-in leys as a source of organic matter.

Intensive vegetable production is carried out on part of Mr. Lowe's farm in an artificial hot-bed kept at 55°F by the heat of evaporation of warmed water in troughs below the soil. This soil gets 100 tons an acre of dung annually and 10 inches of water—1,000 tons of water per acre. Up to eight crops a year of carrots, lettuce, turnips and cauliflowers are grown, the varieties being specially bred and selected to suit the environment. Eight cwt per acre of quick-acting nitrogen fertilizer are needed in mid-May to keep up the available nitrogen level. It has no ill-effects on the colour or quality of the cauliflowers.

GOLD MEDAL FOR LANDOWNERS

The Earl of Iveagh, K.C., G.C.V.O., has become the first recipient of the Gold Medal for Landowners which was presented by Viscount Bledisloe to mark his ninetieth birthday last September. This new award is to be made annually to a landowner who has given outstanding service in encouraging the application of service or technology to husbandry.

The tireless efforts of Lord Iveagh, over many years of a long life, in transforming thousands of acres of extremely poor land in East Anglia into rich pasture and highly productive arable have shown what can be done by the reclamation of very light land to increase food production. For many years, too, he has worked towards improving clean milk production and the general betterment of the dairy industry.

WOODEN TRAYS FOR TOMATOES

Although similar to the well-known "Dutch" type tray and the Jersey tray, a recently issued British Standard version measures 15¼ in. × 11¼ in. × 3 in., and is thus ¼ in. shorter than its Jersey counterpart. With full appreciation of the increasing use of pallets for transporting horticultural products generally, and foreseeing the probability of their wider use for the carriage of tomatoes, the representative B.S.I. Committee on Horticultural Containers decided to recommend the slightly shorter tomato tray because it offers the distinct advantage to the user of more economical stacking on "British Standard" size pallets. These have been adopted internationally and are favoured by the British transport authorities.

Trials have shown that the smaller tray will hold 12 lb of tomatoes quite satisfactorily. Also it is a common practice for second-hand tomato trays to be used to carry six 1 lb punnets of soft fruit, and the size of the new tray is adequate for this purpose.

The standard recommends that the trays be marked "B.S.2892", and expresses the hope that all concerned will adopt this practice.

WATER FOR BROILER CHICKS

Mr. A. F. Gristwood, writing in the current issue of *Farming Review*, reports that poultrymen in the U.S.A. have been quick to appreciate the value of a plentiful supply of fresh, clean water in the rearing of their chickens. During the first 10 days or so, water is supplied to baby chicks in one-gallon glass founts which have a plastic base. The glass fount readily shows the level of water it holds. At least one drinker per hundred chicks is provided; one per 75 chicks is not uncommon. The task of filling a large number daily is speeded up by having water taps at several convenient points in each house.

At first, the water founts are placed with their lips just below the edge of the hover canopy. This takes the chill off the water and encourages baby chicks to drink more. Broiler chicks, which have been debeaked at day-old, will refuse to drink very cold water due to the cold shock on their tender beaks.

CATTLE GRIDS

It is surprising that there are not more cattle grids about. The saving of tractor drivers' time is not having to get down and open gates (and that means saving money too), adds up considerably during a year. And they are quite simple and inexpensive to make. Old tram lines and tubes can often be bought from a scrap-merchant, and old railway sleepers make good supporting walls. If a more permanent job is required, the walls can be made of concrete. The Ministry issues a Fixed Equipment leaflet (No. 7) on this subject which is very well worth while reading.

There is no need, as was thought at one time, to have a deep pit beneath the grid and that water was an additional deterrent. A deep pit adds to the cost and water becomes the grave for suicidal cats and other small animals. Ten to twelve inches below the bars is enough, and with such a shallow depth it is possible to place a grid on the surface of a road with a ramp at each end. On length, one cannot be so dogmatic: 9 ft. is probably about right.

MORE PHEASANTS: BETTER SHOOTING

A really first-rate, thirty-minute colour film, with the title *More Pheasants*, has recently been made by the I.C.I. Film Unit. The theme of the film is that the stocking of pheasants doesn't have to be left to nature and chance but, with comparatively little outlay and labour, you can make sure there is enough game on the ground to provide a worthwhile shoot and some useful receipts.

FARMERS' CLUB CUP: FIRST AWARD

The first presentation of the Farmers' Club Cup was made to Mr. Stephen Cheveley on December 3 by Lady Dorothy Macmillan for his paper on farm capital investment. As "In Brief" noticed in November, this cup was recently given to the Club for presentation annually to the reader of the paper adjudged of the greatest value to agriculture or horticulture.

Book Reviews

Farm Trouble. LAUREN SOTH. Princeton University Press (U.S.A.), Oxford University Press (London). 30*s*.

On the one hand, one-third of American farm families, the author states, use "archaic farming techniques" and live in poverty. On the other, the more efficient and highly productive "commercial" farmers face "the possibility of another long depression" due to "a powerful tendency for farm output to grow faster than the demand for farm products". Estimates, made a few years ago, suggest that the increase in U.S. population and in *per capita* consumption will raise demand by 20 per cent by 1965. By that date, largely as a result of higher inputs of fertilizers, technical chemicals and other resources and of better techniques, output will be up by at least 23 per cent.

This is a familiar thesis. The author's well-written analysis of this complex problem brings to mind many parallels in this and other countries, such as Holland and New Zealand, which are vigorously applying the products of science and modern industry to their agriculture.

The statistical foundations on which Mr. Soth builds his arguments are not always very clear, though they seem to be sound. Few who know America would dispute his main conclusion that, in the U.S.A., "the *major* solution to the surplus situation is to help people to get out of farming". The present high-level Government price supports and acreage controls tend to promote over-production by efficient farmers and to encourage the marginal farmers to stay on the land when they would be better off with a job in the towns. The agricultural subsidies should therefore, he maintains, be paid in more direct form and used primarily for price stabilization and for widening export and domestic markets. Furthermore, money should be spent on research into, and education on, ways and means of reducing the farm population.

Although many of the ideas he develops have been canvassed before, the author, who is an agricultural journalist on the staff of an outstanding Mid-Western newspaper, puts them together in a stimulating, very readable, and by no means academic way. This book should appeal to anyone who is interested in the impact of science and technology on the economic, social and political aspects of farming, or who is in search of a guide through the jungle of American agricultural politics.

A.N.D.

Crucifer Diseases in Ireland. ROBERT MCKAY. The Sign of the Three Candles (Dublin). 21*s*.

Cruciferous crops are grown extensively in Ireland, as in all lands with a temperate climate, and most of the fungus and virus diseases that attack them can be found all over the world. Professor McKay has summarized present knowledge of the diseases that have been recognized in Ireland, and so formidable is the list that it will be useful in many other countries. The book is written for agricultural and horticultural advisers, and it is certainly a helpful summary for people with some scientific training. But the hope is also expressed that it will be of some use to the ordinary farmer and gardener. It is doubtful, however, whether many growers, Irish or English, are likely to persevere with the technical jargon, even with the aid of the glossary provided. They will, however, find non-technical sections on control for each disease, and a good series of photographs, many of which really help to identify the diseases. A key to the macroscopic details described would have been very useful to enable non-specialists to trace a disease.

The author is obviously more at home among the fungi than the viruses, and there are one or two dubious statements on the control of virus diseases. For example, the advice that "brassica seed should be sown as thinly as possible" will result in a higher incidence of disease than in densely-sown beds. The book is not expensive at a guinea, considering the number of plates. There are a few spelling mistakes, but perhaps the printer will provide another candle for the proof-reader in future.

L.B.

The Use of Labour in Farm-scale Vegetable Production. T. K. WARLEY and K. A. INGERSENT. Department of Agricultural Economics, University of Nottingham. 10*s*.

Under the economic conditions ruling today, managerial decisions play an increasingly important part in the business of horticulture. It is not sufficient for a grower to produce heavy crops of high quality; he must also see that every stage in production and marketing is organized in the most economic way and that the most profitable use is made of all the resources at his disposal. This book is a valuable contribution to those resources, and although it is confined mainly to horticultural crops grown on a farm scale, it will be of great help also to small growers. It shows the importance of assessing labour requirements for various crops and of choosing a cropping plan that will ensure an even load, and gives numerous examples of how this can be done.

The investigations covered six different crops. Perhaps the most valuable fact that emerged and one that will make growers think (although many will have suspected it already) is that mechanization is not always the right and profitable answer to labour shortage. The harvesting of vining peas falls in a slack period, yet it has been expensively mechanized and an appreciable acreage is required for break-even costs to be reached; mechanical planting of brassicas can doubtless solve urgent problems at busy times, but plant population is vitally important, and even when the machines are fitted with "clickers" the finished plant may be 3,000 less or 1,500 more than intended; drilling and chopping out may not save labour costs, and the mechanical harvesting of carrots may result in such damage that quality is reduced. There are many other excellent examples of the kinds of assessments that should be carried out, but the studies that were made covered the production stage only. What is wanted now is a further study covering the marketing stage and showing how quality and net returns may be affected by different methods.

The text is straightforward and easily understood; the tables and figures are simple and clear. But many readers will be exasperated by the mass of footnotes. There are as many as seven to a page, and whilst some are used for their proper function of reference, others give useful additional information which should be in the text. Footnotes may be the delight of economists, but economists should know that they also interrupt and irritate a reader.

C.E.P.

Potassium Symposium, 1956. International Potash Institute (Berne). 20*s*.

The main theme of the papers read at the Annual Congress of the International Potash Institute, held in the University College of London in 1956 under the Presidency of Sir E. John Russell, was the relation between potassium and the plant. This report includes the eleven papers read with abstracts in four foreign languages.

In the annual experiments carried out in Great Britain, the largest responses to potash were obtained on potatoes. Roots, clovers and beans came next and cereals last. Sugar beet trials exhibit a substantial positive interaction between nitrogen and potash at the peak level of nitrogen used. An interaction denotes the reinforcement of the effect of one fertilizer by another and illustrates the significance of "balance".

Potassic fertilizers enhance the efficiency of photosynthesis (sugar and starch formation in leaves) and increase the size of individual leaves and the number of living leaves per plant or unit area of the crop. Photosynthesis is reduced by potassium deficiency, but potassium is not directly concerned in protein synthesis. Nitrogen metabolism is affected whatever the source. Putrescine, one of the ptomaines, causes some of the well-known potassium deficiency symptoms.

The important potassium deficiency symptoms are shortening of the internodes, the die-back of shoots, and necrosis and spotting of leaf margins and tips. There is an antagonistic effect of potassium on magnesium, but for glasshouse tomato crops and for fruit crops much less magnesium sulphate is needed to cure plants when the material is applied as a foliage spray instead of as a solid to the soil.

At the final session Sir James Scott-Watson described British farming and its progressive intensification during and since the war.

The book is obtainable from the International Potash Institute, P.O. Box Berne Transit, Switzerland (payment to be made through a bank or by postal order to the Institute's account at the Union Bank of Switzerland in Berne) or through any bookseller.

G.A.C.

Animals Parasitic in Man. (Pelican Medical Series.) GEOFFREY LAPAGE. Penguin Books. 5*s.*

To those who are professionally interested in parasitology, Dr. Lapage has long been known as an assiduous research worker and, more recently, he has extended his activities to popularizing the science. He modestly proclaims this book as "a readable account of the animals that may be parasitic in man in various parts of the world", but to discourse on any science without being pedagogic or naïve demands encyclopaedic information and literary skill of a high order—both amply displayed within these 320 pages. The book will appeal not only to the educated layman but to a wider circle embracing medical men, health visitors, biologists, and the increasing number of chemists who are engaged in the search for therapeutics to combat the mortality and the insiduous morbidity caused by parasites, especially in the tropics and subtropics. Although the emphasis is on *applied* parasitology, with a refreshing ecological approach to *host-parasite relationships*, there is also much to interest the academically or philosophically disposed.

Thus, parasitism began accidentally, it is generally presumed; but why have so many different kinds of animals adopted this *modus vivendi*, particularly in view of the extraordinary hazards in the life cycle of most parasites? Does the sacrifice of the adult, as evidenced by degradation of every structure and function, except those pertaining to reproduction, constitute the acme or the nadir of organic evolution? These and similar problems arising from the study of parasitology in depth must surely stimulate the questing mind. In the course of time, parasites have so adjusted themselves as to occupy niches in a complex pattern of ecological relationships, thereby providing the applied parasitologist with a splendid opportunity of linking science with practice.

Apart from the chapters on malaria and trypanosomiasis, Dr. Lapage elaborates his treatise under headings of convenience rather than logicality, with consequent "lumping" of animals diverse in origin, and some repetition of fundamentals. Another mild criticism concerns the inadequate tribute to research pioneers such as Dubini (1843), Leidy (1846), Bilharz (1851), Leuckart (1855), Lösch (1875), Manson (1878), Laveran (1880) and Ross (1898)—the historical background of any science adds perspective and colour to the pen-portrait. On the whole, however, this is a fascinating, well-written book, notably free from the academic "dry-rot" which sometimes infests more rigidly scientific works.

D.S.MacL.

Freesias. W. F. MCKENZIE. Benn. 8*s.* 6*d.*

Mr. McKenzie's book is disappointing. He is clearly better at handling plants than at handling words, for he would hardly permit, in his flower-beds, such a disarray of material and an absence of labels as too often characterizes the advice given in this little book of some fifty pages. He would, as an horticultural expert, avoid repeating the same crop in the way that he constantly repeats the same items of information. All this spoils what would otherwise be a useful addition to the growing library of handbooks for growers, because the information itself, apart from occasional ambiguities, is thoroughly sound and helpful. Criticism on the technical score can be directed only at the scant attention given in the chapter on pests and diseases to that scourge of the freesia grower, Fusarium, and the lack of any advice on what to do when it appears, as it assuredly will after a few years.

In the chapter on economic considerations emphasis is rightly placed on the peripheral factors such as the other demands on labour and glasshouse space. All that can really be said is that where they have dovetailed with the bread-and-butter lines, freesias were often a highly profitable crop in the past, were less profitable last season, and may well be still less so in the future. The Market Report prices show this, and, at the same time, indicate the heavy premium paid for first-class blooms.

R.L.C.F.

Handbook for Vegetable Growers. JAMES EDWARD KNOTT. Chapman and Hall (London), John Wiley (New York). 32*s*.

Much of the widely-scattered information relating to vegetable production in America is included in this pocket-sized, indexed handbook.

It is essential to realize that although, no doubt, this work gives an accurate impression of American methods and practices, many of its recommendations would not be acceptable to growers in the United Kingdom. This is particularly noticeable in the sections dealing with seeding rates and estimated crop yields. Nevertheless, for the more experienced grower who is able to make allowances where necessary, this handbook should prove useful, as well as interesting.

Most of the information is in tabulated form, and covers a wide range of subjects including harvesting, storage, and seed production. Many of the kinds of vegetable crops listed are not grown over here; varieties are not included. There is much data relating to recent American investigation which has not been presented in such a concise form before in this country.

J.A.S.

Wild Encounters. EILEEN A. SOPER. Routledge and Kegan Paul. 25*s*.

Wild Encounters is a worthy successor to *When Badgers Wake*, and, like it, is much more than a well-written record of personal observations. Any reader who loves the "out-of-doors" will feel akin to the author, for here is a naturalist who finds equal pleasure in studying the ways of a hornet, in watching a bird building its nest, or a family of badgers romping by moonlight. Also, the author is one of those rare and fortunate people who seem to be able, at the outset, to get on terms of understanding with their subjects.

An excellent example of Miss Soper's power of observation is her chapter on birds bathing—a subject that has hitherto been rather neglected. The average countryman, confronted with the act, sees a bird splashing about in shallow water with what appears to be great gusto and enjoyment; but he may not know that different species of birds bathe in markedly different ways—some warily or daintily, some briefly and in a businesslike manner, some long and luxuriously.

As is her custom, the author has illustrated her book with her own drawings, and as always these are masterly. She has the knack of catching, in a few strokes, the essentials of an animal pose or expression. Apart from the drawings of badgers, in which she excels and in which I suspect she takes her greatest pleasure, perhaps the best of this fine and extensive series are the sketches of leverets. The chubby, diffident and appealing character of these attractive little creatures is quite successfully captured. The fox-cub drawings and those of nesting flycatchers, too, are a joy.

The book is very well produced. Paper, make-up, type—all are first rate, and the jacket (the author's work) is just right. Miss Soper's last book was adjudged one of "The Fifty Beautiful British Books of the Year 1955", and it is hard to see how *Wild Encounters* can be omitted from the 1957 honours list.

F.H.L.

Chrysanthemums the Year Round. SYDNEY A. SEARLE and BARRIE J. MACHIN. Blandford Press. 25*s*.

It is a moot point, of course, whether anybody wants chrysanthemums all the year round. Human beings, always seeking the unobtainable, probably do want just this, so the growers, whether they like it or not, will have to provide the blooms. Mr. Searle and Mr. Machin have produced a working treatise which should enable the growers to meet the demand.

The magic in this proposition is the day-length. By altering the day-length for the chrysanthemums, growth can be advanced or retarded so that it is possible, by very careful planning, to have plants in bloom on any day of the year. The physiological explanations of this phenomenon are very lucidly described in the book, and five hundred varieties of chrysanthemums have been classified according to their reactions to this abnormal treatment, so that the grower may know exactly where he is from the outset.

Of course, nothing is so simple as it seems, and this controlled cropping of chrysanthemums can only be achieved by the most rigorous attention to all matters of cultivation. The book deals in detail with propagation, cultivation, disbudding, pest and disease control, and, indeed, all

the routine operations involved in the production of first-class chrysanthemum blooms.

The publishers' notice indicates that the book will be of value also to the amateur grower. So it will, but only, I venture to suggest, to the most advanced of amateurs. Even so, *Chrysanthemums the Year Round* must rank as a classic in horticultural literature, and its possession may make a small fortune for many a chrysanthemum grower.

R.H.

Capital and Credit in Agriculture: International Journal of Agrarian Affairs, Vol. II, No. 3, July, 1957. Oxford University Press. 5*s*.

Today, there is a lively interest in the questions of capital and credit in agriculture. This symposium appears, therefore, at an opportune time.

Four separate contributions describe the position in Denmark, Norway, Sweden and the United Kingdom. This last section, by Andrew Ashby, adds nothing new to our knowledge on the subject, which is woefully inadequate in all conscience (conclusions on such important matters as the sources of capital in U.K. agriculture are drawn from a sample of 152 farms!), but it throws into sharp relief the contrast between the position here and that in the Scandinavian countries. It is in this comparison that the main interest of the symposium lies.

The contrast is remarkable. The U.K. is essentially a country of tenanted farms (nearly 60 per cent). We have a rural banking network probably unrivalled anywhere in the world and bank loans provide the bulk of the industry's credit. Now consider the Scandinavian countries. In Denmark, 96 per cent of all holdings are mortgaged; in Norway, 75 per cent of all loans to agriculture are mortgages; in all three countries joint-stock banks are relatively unimportant, the bulk of agricultural credit being handled by special rural credit associations and land banks which have no parallel here.

Even more interesting are the different attitudes towards credit. Compare, for instance, the remark: ". . . it never occurs to the Danish farmer to use his capital formation for repayment of his loans at the earliest possible date" (that is, he continually re-invests), with: "A Swedish farmer's ambition . . . is to leave his farm unencumbered". The "investment-mindedness" of the Danish farmer is the most outstanding of the many lessons to be drawn from this symposium.

B.E.C.

Dance of the Trees. RICHARD ST BARBE BAKER. Oldbourne Press. 15*s*.

Richard St Barbe Baker is perhaps best regarded as a Forester Extraordinary—a man who sees his life work extending beyond the business of raising trees for timber to the safeguarding of the wealth of the earth for the good of mankind. He tells the fascinating story of his progress, from boyhood on a forest nursery near Southampton through his career as a forest officer in the Colonial Service. First he went to Kenya, where he observed that the Kikuyu tribesmen never began any communal activity, such as the sowing of a corn crop, without first celebrating the event with some rhythmic dance. To enlist their support for tree planting and conservation, he invented the "Dance of the Trees", and this gives his book its name. Later, he served in West Africa and also in Israel, enlisting the support of the local communities for the planting of protective forests to withstand the encroaching deserts.

Subsequently, he has become widely known as the founder and guiding spirit of the society called "Men of the Trees". In that capacity he has visited the mighty redwoods of California, and the eucalyptus forests of Australia; and he has crossed the Sahara Desert in a motor van to investigate the possibility of halting the spread of the desert by a vast "green front" of shelter-belts. His adventures in many lands, and his encounters with people of all races and walks of life, from African peasants to President Roosevelt, are simply told in a way that makes enthralling reading. You can enjoy this book even though you are unlikely to agree with all St Barbe Baker's views, and at the end of it you will admit that there is much sound sense in his standpoint. His statement: "We now know that the so-called indirect value of trees is often greater than their timber value" is particularly apt at a time when our farmers are reflecting seriously on the importance of shelter-belts, and even of hedges and hedgerow trees, to British agriculture.

H.L.E.

Farmer and Stock-Breeder Year Book and Desk Diary, 1958. Farmer and Stock-Breeder, Dorset House, Stamford Street, London, S.E.1. 15*s*.

A warm welcome is again assured for this farming Year Book which well maintains the high standard set by its predecessors in the new format. Any farmer who has not previously invested in this publication will be agreeably surprised by the interest and value which he will extract from it. And "*invest*" is the right word; for it contains an enormous amount of diversified information, very efficiently indexed.

Professor H. I. Moore's "daily task reminders" in the ample diary section are essentially practical tips in the common round, and personally I would buy the book for these alone. Add to all these attributes the forty-eight pages of stock pictures, and you surely have the answer to many a farmer's prayer!

E.D.

Timber Preservation. British Wood Preserving Association and Timber Development Association.

Recent advances in methods of preserving timber have given, quite literally, a new lease of life to one of the oldest of building materials. This handbook, on the preservatives and techniques now available for treating timber before it is put to use, will interest all those concerned with fencing and building.

It discusses in detail why timber deteriorates and the various means of protecting it against fungi, insects and weathering. The subject is complicated, but the reader is guided systematically from general principles through descriptions of preservatives, including such recent developments as chlorinated paraffin waxes and dieldrin, and methods of application, to the criteria by which he should make the particular decision most suitable for his particular case.

For obvious reasons, no costs are given, but there is a valuable appendix on proprietary preservatives. The booklet deserves special praise for the clarity of its style and the effectiveness of its presentation.

Single copies of the booklet may be obtained free from the British Wood Preserving Association, 6 Southampton Place, London, W.C.1, or from the Timber Development Association, 21 College Hill, London, E.C.4.

N.H.

Books Received

Magnesium: the Fifth Major Plant Nutrient. A. Jacob. Staples Press. 40*s*.

The Agricultural Register (New Series): Changes in the Economic Pattern 1956–7. Agricultural Economics Research Institute, University of Oxford. 21*s*.

Economic and Technical Problems of Australia's Rural Industries. D. B. Williams. Melbourne University Press. London: Cambridge University Press. 27*s*. 6*d*.

Pea Growing Research Organisation Report for 1956. (Obtainable from the Pea Research Station, Yaxley, Peterborough.) 2*s*. (free to subscribers to the organisation).

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE by Billing and Sons Limited, Guildford and London

"A fair house with open pillars"

ABINGDON's famous Town Hall, with its noble pillared market space on the ground floor, was built in 1677-80 by Christopher Kempster of Burford. Kempster, a mason-contractor who later worked on St. Paul's Cathedral, was described by Wren as 'a very able man, modest, honest and trea able.' His magnificent building was th fourth—or possibly fifth—market hou to stand on this site. Market day i Abingdon is Monday, as it has been fo at least the past six hundred years.

ICI

FOR AGRICULTURE

CROP PRODUCTION · PLANT PROTECTION · ANIMAL HEALTH